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AMERICAN POTASH INSTITUTE, INC.
INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

VOLUME XXIV NUMBER TWO

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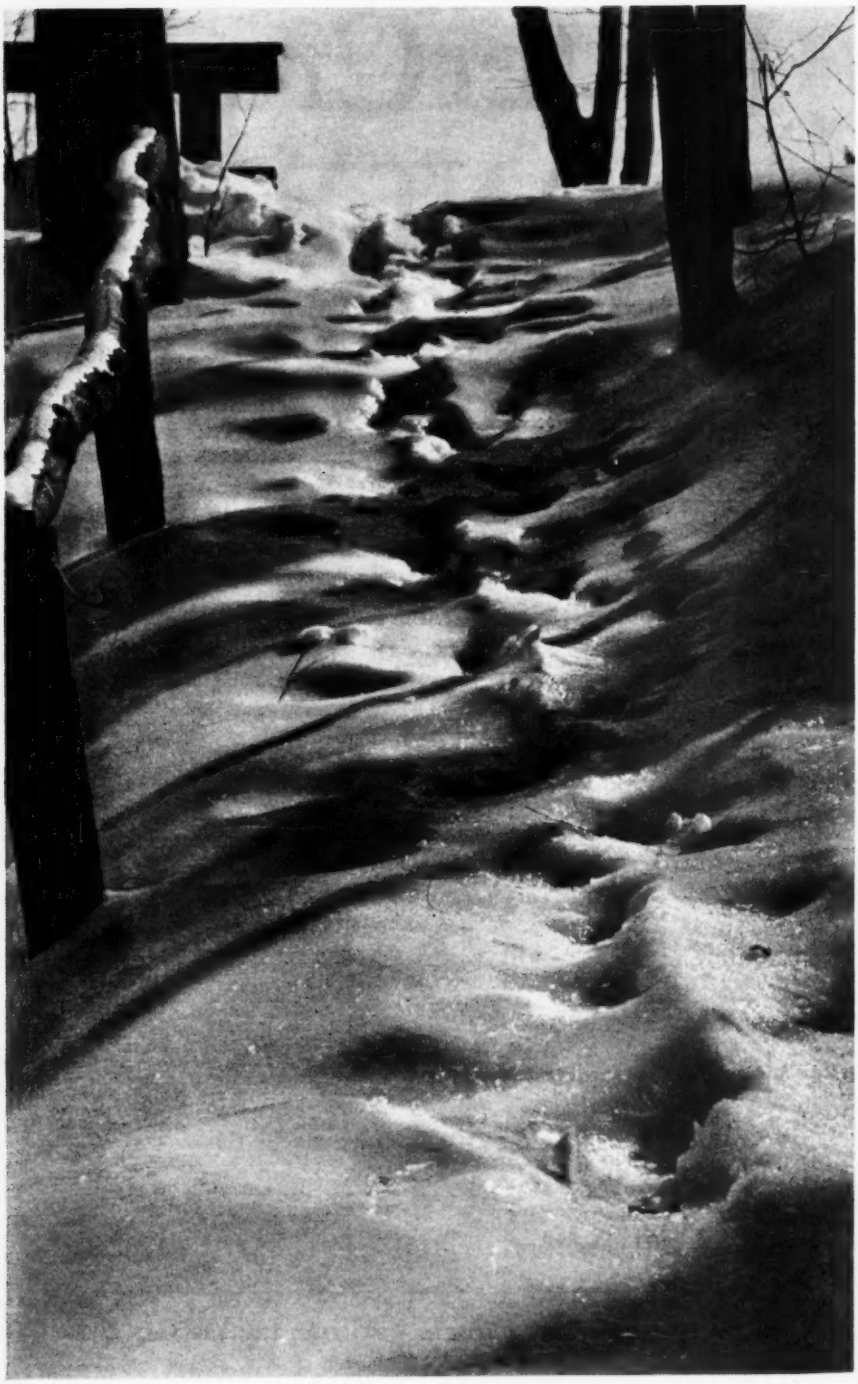

LOVERS' LANE IN WINTER-TIME

Better Crops with PLANT FOOD

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VOL. XXIV WASHINGTON, D. C., FEBRUARY 1940 No. 2

Kidding Ourselves?

Jeff McDermid

BEFORE we continue to kid ourselves another year, let's consider Washington and Lincoln, who are always food for thought in February. Because we are reading so much war news and political forecasts, it behooves us to examine "veritas" or veracity and its effect on personal behavior and the public mind.

George Washington is particularly venerated because he stood for truth. In spite of the cherry tree story which is shadowed with considerable doubt, the Founder as a Virginia gentleman of probity stands unchallenged, and he is thought of almost as a synonym for truth itself.

In my own mental meanderings it seems to me that we should be fair to him on that score, or else be unfair to ourselves. For I think it would be saner to say that General Washington was human and probably as open to error as we are. Therefore, let's amend the rather Pollyanna kind of veneration for him in respect to his veracity. Let us say instead that Washington never deliberately told a falsehood, but that he may have been as shy of the real facts in the case as we are when we take too much for granted. Thus misguided, Washington may have told half-truths to his colonial cronies. He may have allowed Martha to kid the children about Santa Claus or relate the stork-and-baby wheeze sometimes in a pinch.

ABRAHAM LINCOLN, on the other hand, was a human paradox when it comes to veracity. With a backwoods background and a pioneer instinct for teaching by exaggeration, Lincoln is fondly recalled for his burlesques on the facts. Carl Sandburg repeats some of these typical instances of prevarication.

Once Lincoln told a bragging Illinois farmer that in Kentucky the Hanks family grew such a bumper crop of hay that "we stacked all we could outdoors and put the rest in the barn." Another time he settled a boundary row by saying that fences were so crooked in Sangamon County that a hog in trying to get through one always came out on the same side he started.

PERHAPS it was this sort of practical philosophy which made Lincoln coin the later subtle phrase, "You can fool some of the people all of the time and all of the people some of the time, but you can't fool all the people all the time." He was doing what the funsters and comic critics of our day attempt—to relieve us from the strain of forming opinions on facts we are not so sure of anyhow. We can be "much too much" serious and owly over things that seem as real and true to us as they appear distorted to others who have the real facts. You can often emphasize the truth by a whale of a lie, but you sometimes get into trouble trying to repeat for a truth something that is more than half cockeyed.

The older I grow the more broad-minded I become about the truth. Being an amateur at truthfulness, it is beyond my scope to define all the depths of this painful but alluring topic, but we can chaw around the edges anyhow for awhile.

When I was a youth of woodshed punishment size, it was a real torture when Father said it hurt him worse than it did me. I brooded over his anguish long after I was able to sit down again comfortably. If I had paused to analyze the case, it might have brought me doubt and disaffection. But I accepted his statement and conducted myself accordingly. So the next time I skipped school or broke a window I thought of the dumb look of misery on my parent's lineaments at my misdeeds. Therefore I told him nothing whatever of the incident. What he did not know never rose to blight his life. If he found out we both took a licking! (Washington could do it, but I was too tender hearted.)

This aspect of truth is often hard to get across. It entails choosing between fact and fiction for the sake of charity. We do so many other queer things in the name of charity I presume this is all right too. But it's hard to swallow. My pet peeve is the honest-to-crudeness guy who insists on such withering frankness as to say, "You're looking pretty thin and washed up. Better see a doctor." (My wife resents this thing too, but it's fat and dresses that count with her.)

My next best peeve is having to tell someone of no ability that he has sung well or spun a great yarn, by applause or raucous laughter when the farce is over. Or trying to smack my lips cheerily through a sour-dough meal and wondering why my wife accepted the invitation. If Washington had to face such barmy situations and always stuck to the truth, I don't see how he ever got elected president! Has that thought ever occurred to you when worshiping him for veracity?

SO FEBRUARY is a good time to tackle truth—the difficulty of finding it, the trouble we have in recognizing it when we think we have caught it, and the further problem of how much we can afford to tell it when a hoax is better adapted to the circumstance.

To start on, let's take a truth like mathematics. I guess it's the only known subject besides gravitation and death that is not subject to human distortion or contradiction. (One exemption here on the resistance of mathematics to maltreatment would be my old examination papers in algebra.)

I presume we can agree that in mathematics there may be several ways of arriving at the correct answer, but that as a rule there is but one right answer. You are either right or wrong and no half-ways about it.

Why is mathematics not subject to contradiction? Other sciences often are, but not this one. My answer is that mathematics is beyond denial simply be-

cause we have defined it thus through the centuries and have agreed upon its rules and methods. We have agreed that a square has four equal sides and that four times four is sixteen, and nothing else when you are sober. Music, born of mathematics and mathematics itself are universal languages (like bridge whist), because we have all agreed to accept them as they are and not try to hedge on it. Even some kinds of religion have never enjoyed such a status.

BUT how far may we go to simplify other truths and make them accepted facts? One or two examples show that most of our truths and facts are either founded on *definitions* agreed upon or on *observation* and *experience*. (Here's where the lies crop up.)

Suppose I say to you, "A farmer is a hard-working man." Whereat you reply that a certain fellow in the country sleeps late and lets his weeds grow. Whereupon I rejoin, "If this man is lazy he is *not* a farmer." I simply stick to a time-worn, well-defined principle that says farmers are all industrious. It's like establishing the axiom that a Christian is bound to be a good man regardless of some quibbling over church deacons who chew tobacco. (Some strong-minded adherents to truth by definition even insist that farmers are "forgotten men" whenever an election comes along.)

Yet if I hang onto my defined truth about farmers and you stick to your own observed truth about farmers, would you call us both liars? You see our difficulty more clearly perhaps if it be asserted that a professor, a writer, or a congressman is a hard-working man. These groups have not succeeded so well as farmers in fixing hard work as a definition of their calling. My friend who is a professor would insist that it is true, and I as somewhat of a writer would accept that part gladly, but we would disdain to trade our truths. Each of us would, however, find plenty of cases of lazy congressmen. You see, old observation steps in here to make both of us doubtful of any sweeping conclusion outside of our own realm.

But observation is about as trustworthy as Hitler or Stalin. And it often leads us about as far from the truth. Although it doesn't take a course in psychology to prove the tricks that observation plays with truth, I recall reading about a convention of psychologists where this was well proven.

Not far from their hall a mass meeting was in progress. The psychologists arranged to have a clown chase a Chinaman into this meeting, shoot at him, and chase him out again. At once they got fifty or more onlookers to jot down what they saw. There was not one person who scored a completely accurate picture of the actors in this sudden drama. Yet those people probably relied more or less firmly on their newspapers to give them reports of emergencies seen by men with no greater average intelligence than themselves.

This means to me that truth found by observation is clumsy and unreliable, and that by experiment is incomplete and transitory. We think we have the last word in radio broadcasting, but here comes frequency modulation and denies

(*Turn to page* 47)

Balanced Fertilization For Apple Orchards

By M. B. Davis

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THE proper fertilization of an apple orchard is undoubtedly one of the most important orchard operations. It is one of the best means of maintaining a tree in good health, and without healthy trees, one cannot expect profitable returns. An unsatisfactory fertilizer programme may not only reduce yields, but may also destroy the appearance and keeping quality of the resultant crop. It is incumbent on the grower, therefore, to study his trees and be in a position to exercise sound judgment in connection with his fertility problems.

Fig. 1—Showing two types of potash-deficiency scorch. The marginal area and the lesions are a reddish brown colour, while the area immediately next is an olive green colour.

Until fairly recently, much of the advice given to growers has been in the nature of rule-of-thumb recommendations based upon experimental evidence obtained, perhaps, from orchards located on soil types different from those to which the information has been applied.

There are at least two main factors which upset the possibility of ever being able to take the results of any fixed experiment and use them as a basis for a rule-of-thumb recommendation for general application. The first factor is the variation in the composition and food content of the original orchard soil, and the second is the past treatment or history of the soils after they have come under the control of man.

The most important fundamental principle to establish in one's mind is the importance of a balanced ration for plants; another is that as soils differ in their make-up so must the fertilizer application from district to district, and perhaps from orchard to orchard; another is that any single or two-element treatment over a period of time is liable to bring about a deficiency of some other element and thus necessitate a change in the fertilizer programme. Thus, given at the outset the best possible soil, that is, one in which all elements of plant food are present in ample amounts, the following treatments over a period of time could induce the following troubles:

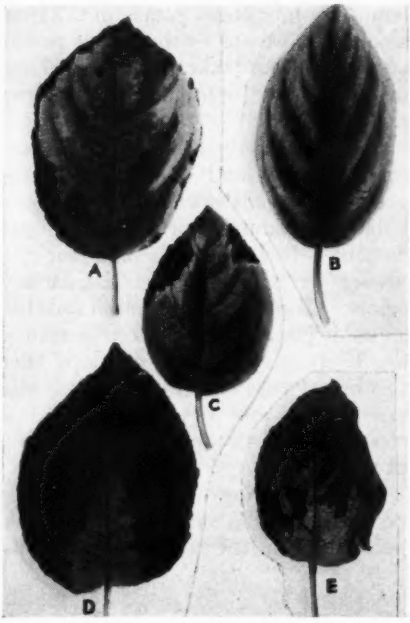

Fig. 2—Various forms of magnesium-deficiency symptoms. The lesions are nut brown in colour, while the areas next the lesions are either chlorotic or normal green.

(1) Continuous nitrogen applications could result in a potassium or even a general mineral deficiency.

(2) Continuous phosphorus applications could result in a deficiency of potassium.

(3) Continuous applications of lime, if in the form of a carbonate, could induce a deficiency of iron; or if in the form of a sulphate might only cause interference with the intake of potassium and be responsible for the occurrence of certain physiological disorders of fruits.

(4) Continuous applications of potassium over a long period might induce a deficiency of magnesium. This latter is a more remote possibility than the other three but could occur.

Nitrogen—This element is absolutely essential for plant growth and is the one which is generally most lacking in our Eastern soils. Such remarkable responses were obtained from its application in past years that many growers have been led to believe that a nitrogen-only fertilizer policy is all that is necessary. This has led in many cases to a comparative excess of this element, as will be discussed later.

Fortunately, the lack of nitrogen is very quickly expressed by the plant in the form of pale-coloured foliage, small in size, and short growth, generally of a slender nature. Plants suffering from a lack of nitrogen never have nice dark foliage; the leaves are not large and do not exhibit scorched or browned margins or patches as is the case with leaves suffering from mineral deficiencies. Trees suffering from an excess of nitrogen exhibit an excess of growth, with large leaves at first of a dark green colour. Later these leaves show a puckering at the tip, followed by a browning or burning, and sometimes this browning or scorching may occur on the margins and spread to the center of the leaf.

Up to a certain point excess symptoms

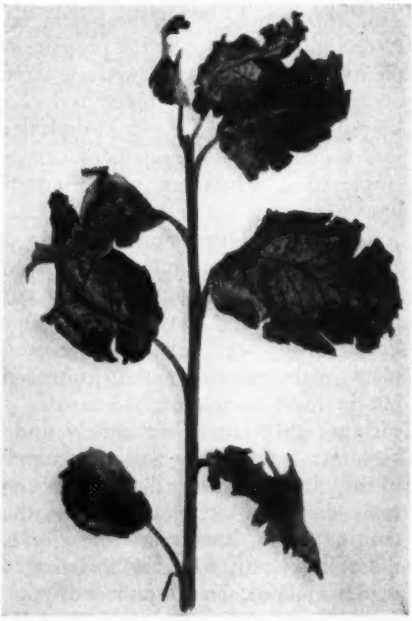

Fig. 3—A young twig from a tree in advanced stages of potash deficiency. In this case the margins are of a cigar-ash gray colour.

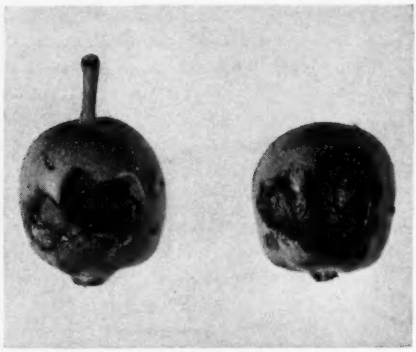

Fig. 4—Young apples affected with drought spot.

of nitrogen in the form of burning may be overcome by an available supply of potassium, as there is a distinct relationship between these two elements in plant growth. One thing which must be kept in mind is that the greater amount of nitrogen fed the greater the demand will be for potassium and other mineral elements. It is safer to feed a large amount of nitrogen to a soil known to be well stocked with minerals than to feed it to a soil known to be low in those elements. Excess nitrogen, even in the presence of plenty of minerals, can produce large, oversize fruit of poor colour and poor keeping quality. Keep in mind that this quickly available element can be employed as a balancer in a sane fertilizer practice.

Potassium—This element is just as essential as nitrogen, but its lack is not expressed so quickly and cannot be corrected so rapidly. On the average our Eastern soils are probably better supplied with potassium than nitrogen, but in most cases none are capable of carrying an orchard indefinitely under high nitrogen feedings without a supply of this element. The ash of apples contains about 50% of potassium, so that fruiting trees draw rather heavily on the soil for this food. One barrel of apples contains about 4 ounces of potassium or the equivalent of ½ pound of muriate of potash, so that a tree producing a crop of 4 barrels would use up 2 pounds of muriate of potash in the fruit alone. It is easy to see that over a period of years it would take a pretty good soil to continue to supply this without any replenishment.

Potash is necessary in the translocation of sugars and starches, and trees growing on soils low in potassium are liable to produce fruit of lower sugar content. It is also essential for the proper development of a satisfactory colour. Fruit from low potash soils has a muddy green, ground colour instead of the lively green which develops later to a bright yellow. This element is also essential to root development and is closely related to the water relationship of the tree.

Trees suffering from deficiency of potassium exhibit various symptoms depending upon the severity of the defi-

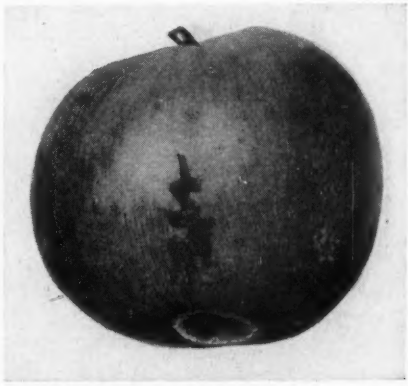

Fig. 5—A McIntosh apple at harvest very slightly affected with drought spot.

ciency, and the time or season of the year that the symptoms are observed.

Excepting in cases of rather severe potassium deficiency, the very young or terminal leaves on a shoot or twig do not show any deficiency symptoms, but the older or basal leaves exhibit a type of browning or scorch of varying severity. In very mild cases the foliage may be of a very dark green colour with a very slight browning at the tip. In more severe cases the foliage, upon close examination, may reveal a faint mar-

ginal chlorosis which still later may turn to a definite scorch. Frequently this marginal scorch is rather a bright, reddish-brown colour, although it may be of a darkish brown shade. As the season progresses this colour darkens and presents on the extreme margin a typical cigar-ash gray appearance.

Sometimes the scorch is not entirely confined to the margin, as is shown in figure 1, and may become confused with a type of browning or scorch due to magnesium deficiency. There appears to be in most cases, however, a fine distinction as follows: If the scorch is due to potassium deficiency, the area just next to the scorched or browned tissue will present an olive colouration, see figure 1. If due to magnesium deficiency this is not present, either the area is the natural green of the leaf or is

Fig. 6—McIntosh apple at harvest badly affected with drought spot.

chlorotic as shown and described under magnesium deficiency.

During the early years of a potash-deficient condition, production may actually be increased, due to an abnormal development of fruit buds. Later there may be a distinct loss of crop due to the die-back of shoots which would normally replenish the fruit bud system of the tree. Generally speaking, die-back occurs only when the tree has been suffering from potash deficiency for an

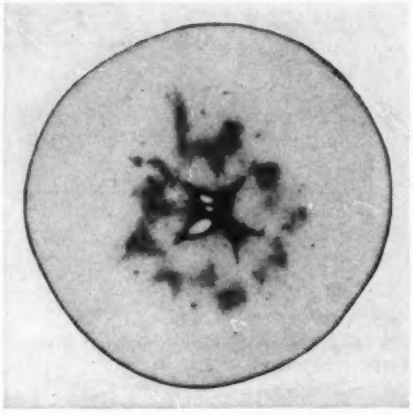

Fig. 7—Cross section of a McIntosh apple at harvest affected with corky core.

extended time. Trees appear to be able to re-utilise potassium for a while; that is, they have the ability to take it from older portions for the benefit of the newer growth, but this comes ultimately to an end when die-back commences.

Cases of potassium deficiency are becoming more common in eastern Canada, and examples of the success of diagnosis and the application of the suggested remedial measures are multiplying rapidly. One example of a young orchard is sufficient to illustrate this. A young orchard planted in 1934 failed to respond to the application of any fertilizer treatment including manure, or even complete fertilizer. The trees reached the state at the end of the third year when no growth was being made, and the early demise of the orchard was expected.

Since the foliage exhibited marked potassium scorch, it was suggested that 1 pound of muriate of potash be applied in the fall to each tree. This was done, and the results were quite miraculous the following season. The trees put forth excellent growth, scorch was eliminated, and the orchard presented an exceptionally fine appearance, excepting a few trees that were left as checks and which were almost defoliated by late August from extreme scorch.

Phosphorus—The third important ele-

Fig. 8—An apple affected with internal cork.

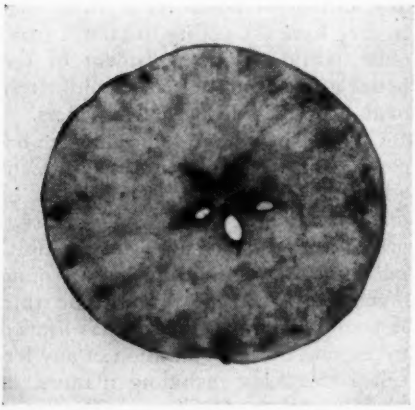

Fig. 9—Cross section of an apple affected with internal cork.

ment is phosphorus. Whilst it, also, is essential to plant growth, it is not used by an apple tree to the same extent as potassium, and actual cases of phosphorus starvation are much rarer than cases of potassium starvation. Trees grown in sand cultures succumb very quickly to phosphorus deficiency, since the plant does not appear to be able to re-utilise this element to the same extent as it re-utilises potash. Trees that have a bad attack of phosphorus deficiency lose their fruit and leaf buds until only a few remain, so that the tree presents a bare pole appearance. The foliage is dull in appearance and early in the summer exhibits purple and bronze effects. Later in the season some of the bronzed areas become dried out in appearance.

While phosphorus is recommended in a complete fertilizer, our results indicate that many recommendations in use are proportionately too high in this element. Furthermore, our results indicate it is very important in relation to the quality and keeping quality of the fruit, and that there is a close relationship in this respect between phosphorus and nitrogen.

Calcium—This element is just as essential in plant growth as any of those mentioned, but we have not seen any actual cases of calcium starvation of apple trees in the field. Pot trees suffering from a deficiency of this element produce rather large and luxuriant foliage for a time; later the foliage becomes normal in size and will probably exhibit dead patches on the margins and in the center. An excess of lime is a more common situation in the field. Where it exists physiological troubles, such as drought spot and cork, are prevalent. This will be discussed later under physiological disorders.

Magnesium is an element essential in the production of the chlorophyll of leaves, so that an actual deficiency of this element can cause serious trouble. In the early stages of magnesium starvation the leaf is at least normal in size, and this may continue for at least three seasons. As starvation continues, however, leaf size may be reduced, and large patches of dead tissue may occur, either on the margins or in the center. The scorch caused by magnesium deficiency may be confused with the scorch of potassium deficiency, but careful observation reveals marked differences.

In the first place, the scorch, even though it may be marginal, is of a clear nut brown shade and lacks the reddish brown hue and the cigar-ash gray appearance of potassium deficiency. Then again, a tree suffering from magnesium

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Pasture Problems Still Unsolved

By Ford S. Prince

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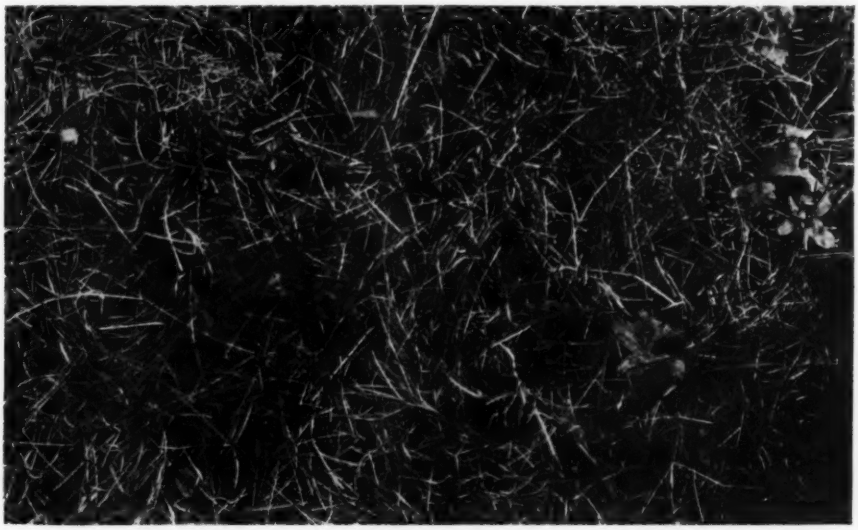
IF I were to make the statement implied in the title which I have chosen for this article to individual farmers, many of them would immediately give me the horse laugh, for a lot of individual pasture improvement has been done in New England and in the northeast region as a whole. It is the total pasture problem about which I am thinking. And as a region, particularly in relation to New England, the pasture problem, which has occupied the attention of a number of investigators, many farmers, several writers, and a great many commercial interests, is still unsolved.

By this, I mean that on the whole, there is still a shortage of ample grazing during the growing season when cows and young stock alike should be getting the major part of their sustenance from green grass and clovers and harvesting it themselves. So long as Dairy Herd Improvement Association records indicate that farmers feed a full grain ration the year round, and when the average amount of grain fed for a whole year runs at the rate of 1 pound for 3 pounds or less of milk produced, just that long we will have a pasture problem that is unsolved.

It would be unfair if I did not state at the outset that certain farmers have given serious thought to securing ade-



Nitrogen-phosphoric acid treatment. Note lack of clover in stand. Yields secured by clipping have been approximately the same as from plots treated with nitrogen-potash, but the grass is less palatable and much less closely grazed.

quate pasture. A variety of methods have been used to attain this end. Some tillable pasture has been plowed and reseeded. Field land not needed on individual farms has been turned over to pasture in the farm management scheme.

Many pastures have been divided for controlled grazing. In certain instances abandoned farms have been bought and the old field land has been turned out to pasture. Annual crops, such as oats and Japanese millet, or soybeans and Hungarian millet have been seeded especially for summer pasture. Mowing lands are commonly pastured in the fall in many localities. And some permanent pasture land has been improved by top-dressing and brush removal. But not enough!

By and large New England farmers have not done enough work in their permanent pastures. Even with the stimulus of the Agricultural Conservation Program, pasture improvement has lagged behind the use of materials on field land.

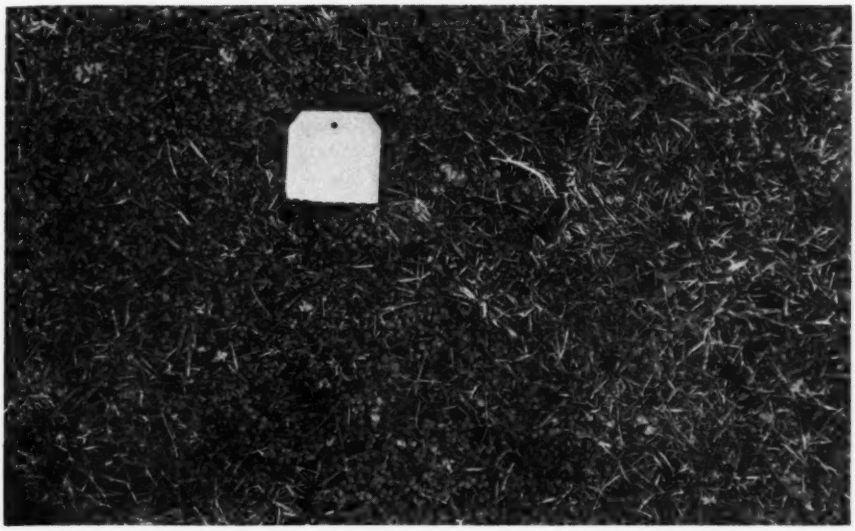
Let's look at the record. The data below refer to the use that was made of materials in the Agricultural Conservation Program in two southern New Hampshire counties, and the amounts indicated are percentages of such materials used for top-dressing pastures.

	Per Cent Materials Used on Pasture	
	County No. 1	County No. 2
Lime	5.5%	3.5%
Superphosphate	9.8%	14.0%
Muriate of potash	8.5%	28.0%

Nitrogen-potash treatment, a well-balanced sod with both clover and grass, and very closely grazed.

County number 2 is one in which a special effort has been made to get farmers interested in pasture improvement, yet with this urge, less than 20% of the three materials have been used in top-dressing pastures. In the other county considerably less than 10% of the materials have been so used. In one of these counties, herd improvement records show a one to three grain ration being fed!

The question naturally arises, "Why aren't more of these materials being diverted to pastures?" The answer, as I get it from attending certain farmer meetings lately, is that farmers started



Nitrogen—phosphoric acid—potash treatment gave the highest yields with about the same balance between grass and clover as the nitrogen-potash treatment.

into the Agricultural Conservation Program with a lime and fertilizer deficiency in their crop land. When this deficiency is met, or, in other words, when they have been around over their field land with lime, superphosphate, and potash, then they will begin to do something about their pastures. Meanwhile, the permanent pastures are becoming further depleted, and the brush is getting bigger and more expensive to cut.

Salvage Only Best Pasture

No one is so sanguine as to believe that all the so-called permanent pasture land in any of our northeastern States is worthy of improvement. Some of it has headed too far to forest. In New Hampshire, where I am most familiar with conditions, it is probable that out of the million or so acres of so-called permanent pasture there are between one and two hundred thousand acres that can be salvaged without too much expense, and which in the end will make excellent pasture. There is about an equal area of tillable pasture in this State. If a moderate amount of improvement were practiced on these areas, there would be ample feed for all the livestock in the State, and the amount of grain necessary to buy during the summer would be kept at a minimum. When and if this happens, 10-cow herds will have 20 acres to roam over instead of from 50 to 100 acres which they have at the present time.

The next question that naturally arises is this, "Why, other than for financial reasons, haven't farmers seen this picture already?"

The answer to this question seems to be that few farmers have really taken a pasture-woodland inventory, to see where their best grazing land is and to determine where are their best prospects for forests. A delineation of pasture and forest areas is needed on most farms to determine these facts, and when this is done pasture improvement work will go forward more rapidly. If a dairyman has 100 acres of woodland or brushy pasture for a 10-cow herd, he cannot be blamed for being discouraged about treating the whole area. But if he simmers his pasture down to the best 20 acres, then he need not feel so discouraged but should be able to do some-

thing about it. And this is what will likely happen.

There are two arguments that have been set forth which tend to discourage rather than further the pasture improvement program. One is grass silage. Some now argue that it may be better to put grass crops into the silo for summer feeding rather than to improve pastures. This may be feasible on some farms, but on the larger bulk of them it is not. Making grass silage interferes with hay yields, and most farmers are set up so that their livestock is limited by the amount of hay they can produce. This is not advanced as an argument against grass silage, which has proved to be a wonderful feed. It merely means that it will not solve the pasture problem on very many farms, particularly so since it aggravates the labor situation.

The other discouraging argument is set forth because of surplus milk, certain men feeling that a broad increase in pasture improvement might mean more troublesome surpluses. Farmers can just as well allow their pasture increase to offset some of the grain they now feed and hold their milk production at a constant level. And so long as our farmers feed the narrow grain-milk ratio that now prevails, this argument is not exceedingly valid. Perhaps we will need an educational program as to the proper method of feeding grain on productive pastures, but this can be run coincidently with the large-scale improvement work when it comes.

Methods, Amounts, and Materials

Meanwhile a vast amount of data has been accumulating from the researches of men interested in how best to proceed in renovating our old, impoverished, northeastern pastures. Data on fertilizers and the need for them on these worn pasture lands are quite convincing and conclusive. Ways and means to show best brush control methods are in progress. It is fortunate that all lands that will be improved for grazing are not already covered with brush and shrubs, but brush control is a factor on a good many farms.

Investigators are not in complete agreement in all cases as to the best methods, amounts of, and materials to use in building up the fertility of pasture soils. The stage of depletion the pasture is in is doubtless a factor. The kind of soil and its basic fertility is another factor. Then on individual farms the needs of the herd at different seasons of the year are of paramount importance and may be the deciding factor as to how much nitrogen, if any, is used in the fertilizer procedure, especially on the heavier soils. Some of the lighter soils, which are naturally susceptible to drought, respond more to nitrogen than to other elements and cannot be depended upon too much for midsummer feed.

Experiment Indicates Needs

In our New Hampshire studies in fertilizing old pastures, we have found that lime, if needed, superphosphate, and potash all stimulate the sod to about the same degree. One pasture gave very little response to potash, but many other trials have indicated that potash may be even more essential to the growth of clover and grass than superphosphate. This is especially true of the Connecticut Valley area where a potash deficiency appears to exist.

We have been conducting a pasture experiment in the heart of this valley for the past 7 years. The field on which the experiment is located was probably formerly cropped, but it has been in pasture for many years. During the first 5 years of our test the treatments were not changed, but in 1938 certain modifications were made in the treatments to arrive at further comparisons between nitrogen and complete fertilizer plots.

The results for the first 5 years are presented in tabular form, with the acre dry matter and protein yields calculated on a comparative basis, using 100 as the untreated plot yields. The percent-

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Land being made healthy on the farm of G. B. Price of Ashe County, North Carolina. To the rear of the barn may be seen a portion of the pasture plots under test by the North Carolina Agricultural Experiment Station.

Healthy Hunger

By F. H. Jeter

Editor, Agricultural Extension Service, Raleigh, North Carolina

HAVE you ever been real hungry? Not the degrading sort of hunger one reads about in city newspapers of downs and outs pleading for a dime to "buyacuppacoffy"; but the healthy sort, such as when you are out hunting possums on a clear, crisp night of early fall and have no compunctions about robbing the sweet potato patch of a sleeping farmer? Or the kind that assails you when you have been out in some ocean inlet on the coast of North Carolina all day trolling for the mighty drum or channel bass and find it hard not to tackle the luncheon packed for you in the dim light of that long ago early morning? Or when you have been rabbit hunting all of a chilly December day and return cold and tired? That's real, healthy hunger.

Apparently, when one is in good health and engages in any unusual out of door activity, then normal hunger follows, and that's an excellent indication of surging vitality. I was not surprised, therefore, when Dennis Sutton, County Agent of Rowan County, North Carolina, took me out to visit the 486-acre farm of C. A. Brown near Cleveland and showed me hungry land. Mr. Brown had 23 acres of cotton in one field and was picking at the rate of two 500-pound bales to the acre. This means that the 23 acres were producing 46 bales of cotton, and that spells money in any language.

But here is the interesting thing. Mr. Brown has 30 acres in pasture. He has 20 acres of as fine alfalfa as one could wish to see. The field yielded 3 tons of dry hay per acre for the four cuttings made in 1939, and at $30 a ton, that's more money. He was feeding four cars of beef cattle, which meant that

he also was producing grain, was growing plenty of clover for temporary grazing and for hay, and was so rotating his land that he might produce an abundance of feed.

He told me that he was selling several hundred pounds of finished hogs each season, and that he rotated some of his temporary pastures with oats and lespedeza one year followed by sweet clover the next. It was no unusual thing to make from 60 to 70 bushels of oats an acre by this practice, and only a blind person could fail to see that he was growing an enormous amount of hay and grazing.

County Agent Dennis Sutton of Rowan County (right) talks with C. A. Brown,, Jr. (left) of Cleveland about the 2-bale per acre cotton grown on his father's farm.

Maintains a Healthy Soil

In short, Mr. Brown is one of the best farmers in a county known for its good farming. All of which leads up to the thought that a man who farms in this fashion in the South must have healthy soil. Mr. Brown's soil is exactly that. It has been limed, rotated with legumes, terraced, and improved. Almost any field on the place will make good yields of any crop planted, given a favorable season. This farmer has limed his soil so well that he says he can keep it in good shape, or nearly neutral as to acidity, by applying some basic slag each fall for his clovers and small grain. In this way, he also adds some phosphate.

But to go back to the beginning. "How did you fertilize that field of cotton?" I asked.

"We used 400 pounds per acre of a 4-10-10," he replied. At this point Mr. Sutton, the county agent, interposed a word. He pointed out that Rowan farmers began years ago to build their soils with limestone, legumes, and livestock. W. G. Yeager had preceded him as farm agent in the county, he said, and nowhere in North Carolina or elsewhere had there been a better agent than Mr. Yeager. He preached legumes and soil building to his cooperating farmers, and he had made Rowan the clover county of the State. This made for healthy, fertile soils. But now that these soils were doing a good job of bringing forth fruit in their season, they had begun to get hungry.

"And that," said Mr. Sutton, "means that we have had to add more potash to our fertilizer mixtures."

If this land in Rowan were just ordi-

nary, shallow, farm land with but a few inches of top-soil and mostly eroded subsoil on which stranded tenants were attempting to make a precarious sort of living, we could accept Mr. Sutton's comment without any further thought. But the records show that Rowan has more tractors for farm work than any other county in North Carolina. This indicates that Rowan farmers can plow down into a deep soil made fertile by legumes and turn the earth to the weathering effects of Nature, and should not need this extra potash. However, years of cropping with legumes are having an effect. The land for the most part is strong and healthy, filled with humus. The farmers grew red clover on it years ago, and then during these later years when times have not been so good, they went to the cheaper lespedeza. Now they are coming back to crimson clover, sweet clover, and red clover. They have built a healthy, vigorous land, but this land is hungry—hungry because of the work it has had to do. When this hunger is appeased by proper applications of potash and phosphate, yields are stepped up to where they are profitable.

Growing Market for Milk

The Carnation Company has just built two milk receiving stations in piedmont Carolina. One is at Statesville in Iredell County. The plant is fully equipped to handle the 28,000 pounds of milk a day that farmers of the surrounding section are bringing in, but it is a temporary receiving plant shortly to become the boiler room of a costly modern condensery, which reports say will be under construction early in 1940.

The other station is at Albemarle in Stanly County and will be a feeder to the Statesville plant. Reports are that a third receiving station will be established at Shelby in Cleveland County. This assures farmers of the North Carolina piedmont country of a stable and dependable market for all the manufacturing milk that they can produce in years to come. They must build more and better pastures however, get better cows, and plant more grazing and hay crops. This must be done so that they can produce milk in such volume that the cost of production will be low and the consequent profits greater. As they go into this kind of farming, they will build healthy, vigorous soils, and experience indicates that such soils will be hungry soils. They will find, as many others are finding now, that the growing of legumes is not the whole answer to a fertile soil.

New Cheese Factory Built

Over in Ashe County, northwest of Iredell and in the mountains, the Kraft-Phenix Cheese Company has built a $75,000 factory, which will manufacture 500,000 pounds of cheese this year. It is the leading manufacturing industry in the county, and the mountain farmers are milking some 10,000 cows of assorted breeds to supply the milk this plant needs. The milk is of superb quality without the common odors of onion, garlic, and off-flavor shrubs, for grass and clovers grow luxuriantly here on top of the Blue Ridge. The manager of the plant told me that he took first honors as to the quality of his cheese in a contest staged at Chicago between all the Kraft plants. Here then is another dependable market which will help build healthy soils.

Later, I drove out to Rich Hill Farm owned by G. B. Price and found one of the oldest outlying field demonstrations conducted by the North Carolina Experiment Station. Spread out up there on the sloping side of a mountain are six 3-acre plots fenced off and pastured by 18 of Mr. Price's 40 Guernsey cows. He sells his milk to the Kraft factory, and he says the pastures have been in sod for 25 years. The best of the plots is the one which has been limed but which also receives an annual application of 200 pounds of 16 per cent superphosphate, 100 pounds of muriate of potash, and 100 pounds of nitrate of

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Lime is your G Man to destroy Public Enemy Number 1

Soil Acidity

By George D. Scarseth

Soil Chemist, Purdue University Agricultural Experiment Station

This is the first of several digests written to be understood by the general reader interested in soils and in the growing of plants. The scientific literature dealing with each topic is so voluminous that most people do not find time to read and to understand the general principles involved, nor to correlate the technical facts into practical form.

Each topic will be written as simply as possible. Analogies are used to tie the complex and sometimes strange facts to the experiences common to everybody. It is the hope of the author that these brief sketches will contain some of the basic material a person needs when thinking about and working out a solution for his own soil problems.

LIMING the soil is like lathering the face before shaving. The face is only being prepared for better shaving in the lathering process. Liming the soil only prepares it for better crop production. The best crop production requires the use of fertilizers carrying nitrogen, phosphate, and potash, and sometimes other plant foods, just as shaving requires a razor in addition to the lathering.

To use fertilizers on acid soils without using lime to correct the acidity is like trying to run a race with lead weights in your pockets.

An effective soil-building rotation to use without lime or legumes is to use the White Man and Indian rotation. Let the White Man have the soil 100 years to destroy it and the Indian have it 5,000 years to rebuild it with forests. The forests "limed" the soils by pumping back to the surface through its deep roots the soluble plant foods (calcium, magnesium, potassium, etc.) which limed the soil as the leaves fell to the ground and decayed.

Who Is This Fellow "Soil Acidity"? The principal acid in soils is not hydrochloric, nitric, or the common drugstore acids. Such acids are soluble and would easily wash out of the soil, resulting in decreased acidity. But we know soil acidity increases with prolonged movement of rainwater through the soil. This comes about because *the main soil acids are the particles of clay* themselves.

The clays do not wash out of the soil by leaching, but the calcium, magnesium, and potassium (all important plant foods) that were fastened (absorbed) to the surfaces of the clay when the soil was virgin or very fertile and full of these alkaline elements have become loosened and washed down and out of the soil. When the clay particles are saturated with calcium, magnesium, and potassium, the soil has no acidity and is called alkaline or "sweet." When these alkaline plant foods are leached out, the hydrogen from the soil waters (H_2O) becomes attached to the spots on the clays where these "food ele-

ments" had been removed, with the result that the soil became acidic. (All acids are produced by hydrogen when it is in an active form known as an ion.)

There are other acids too, like organic acids, produced by decomposing vegetable matter, but it is the clay acid that gives us the greatest concern. Since the clays in soils are the principal acids, a heavy soil with lots of clay would have more acidity to be destroyed (neutralized) by liming than a sandy soil with only a small amount of clay in it. The relation between the clay content of soils and the amount of lime necessary to destroy the acidity is illustrated in the diagram.

How Strong Is "Soil Acidity"? The strength (intensity) of acids is stated somewhat like the sizes or gauges of wire. In wires, the smaller the gauge number the heavier the wire. The gauge in soil acidity is called the pH scale. Here too, the smaller the number of the pH scale the stronger the acid. Thus, a pH of 4.5 is about an extreme acidity for any soil. A pH of 7.0 is neutral, and above pH 7.0 the soil is alkaline or sweet and contains free lime.

What do we mean when we say that pH values express only the strength of the acidity and tell nothing about the amount of acidity? It is easier to understand this when compared to the intensity and capacity of heat.

Heat is measured in temperature and calories. The degrees indicate the intensity (strength) of heat only, and the calories indicate the amount of heat. Thus, a chunk of rock at a temperature of 70°F. could be heated to 100° easily if the rock was only one cubic inch in size, because the heat capacity (calories) was small. But, if the rock was very large, as big as a house, the heat (calories) needed to produce the same temperature changes would be great because of the much greater heat capacity of the bigger rock. Both rocks at the same temperature would register the same heat intensity, yet the amount of

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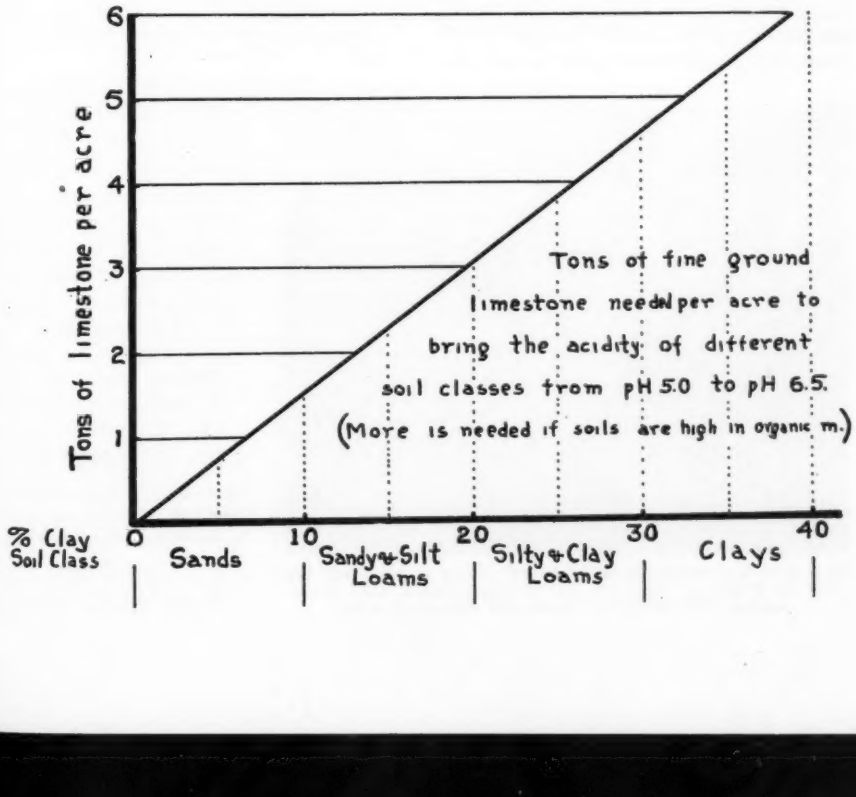


Lawns for the South

By R. O. Monosmith

Extension Horticulturist, Mississippi State College, State College, Mississippi

THE lawn serves the same purpose in the yard, garden, or outdoor living room as the rug serves in the living room, dining room, or bedroom. If you could change that $50 rug in the living room into an expensive, thick oriental rug by giving it a good cleaning and applying a few cents worth of crystals you would certainly take advantage of the opportunity. The lawn can be changed from a worn, thin, spotty condition to a smooth, thick green turf, comparable with a rich oriental rug, by a thorough stirring, fertilization, and seeding or sodding. The cost will be small; the results worthwhile.

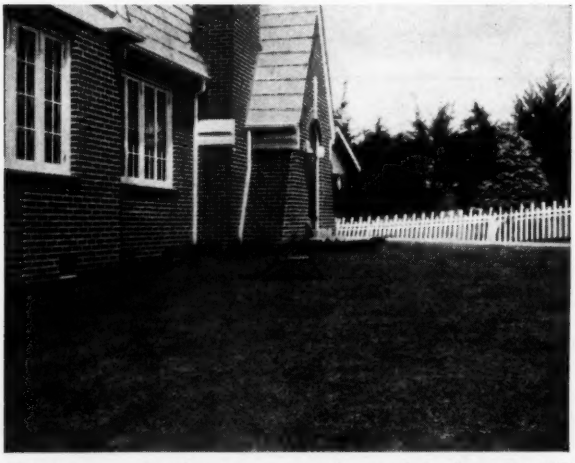
The lawn is the most important part of the landscape picture. It furnishes the setting for the house and garden, prevents erosion, eliminates dust and mud, and adds to the cool comfort of the home and grounds. In spite of all these advantages the lawn is usually poor, thin, weedy, or entirely lacking.

The heat of Southern summers combined with relatively dry periods during July and August limits the variety of grasses that can be used for lawns in the South. The success of a Southern lawn depends upon the selection of the proper grass suited to certain sections of the South and to the local conditions of sun, shade, and moisture. The right grass can only succeed when suitable soil preparation is made, plant food supplied, grass correctly planted, watered, and clipped.

The following grasses may be used successfully in the South for conditions and locations indicated:

Southern Tennessee, Northern Mississippi, Alabama, and Georgia

1. Bermuda—Sun or slight shade. Plants or seed. Two to three pounds of good quality seed per 1,000 square feet.
2. Kentucky Bluegrass—Shade only. Seed. Use 3 to 4 pounds of seed per 1,000 square feet.
3. Lespedeza or Japanese Clover—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
4. English Rye Grass—Sun or slight shade. Winter lawn. Seed. One pound of seed per 100 square feet.



This lawn was developed on new soil moved in from the hill above in 2 months' time. It was fertilized with a 4-8-8 before sodding and top-dressed later with nitrate of soda.

Northern Louisiana, Central Mississippi, Alabama, and Georgia

1. Bermuda—Sun or slight shade. Plants

or seed. Two to three pounds of good quality seed per 1,000 square feet.

2. Carpet Grass—Sun or slight shade. Seed. Two to three pounds of seed per 1,000 square feet.
3. Lespedeza or Japanese Clover—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
4. English Rye Grass—Sun or slight shade. Winter lawn. Seed. One pound of seed per 100 square feet.

Southern Louisiana, Mississippi, Alabama, and Georgia

1. Bermuda—Sun or slight shade. Plants or seed. Two to three pounds of good quality seed per 1,000 square feet.
2. Carpet Grass—Sun or slight shade. Seed. Two to three pounds of seed per 1,000 square feet.
3. St. Augustine Grass—Sun or shade. Cuttings.
4. Centipede Grass—Sun, dry sandy soils. Cuttings.
5. Lespedeza or Japanese Clover—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
6. English Rye Grass—Sun or slight shade. Winter lawns. Seed. One pound of seed per 100 square feet.

The soil best suited to the growing of lawn grass is a sandy loam that is well-supplied with organic matter, nitrogen, phosphorus, and potash. Even this type of soil can lack the necessary friability or looseness so necessary for vigorous grass growth. Rains and traffic pack even the best of soils, and whether the lawn to be made is a new one, or an old one being made over, the ground should be plowed to a depth of 6 or 8 inches, disked thoroughly, harrowed, and dragged smooth.

If the soil is a heavy clay it can be improved by the addition of a top-dressing of one inch of sand and organic matter. This should be plowed into the top 6 inches of soil. Sandy soils can be improved by the addition of a 1-inch layer of organic matter, such as well-decayed stable or barnyard manure, composted straw or grass, woods' earth, or leaf mold. Thorough plowing is recommended to mix this material with the top 6 inches of soil.

Grasses are heavy feeders, and their shallow roots feed in the upper 6-inch layer of soil. An application of 25 pounds of standard 6-8-8 fertilizer to each 1,000 square feet of lawn surface should be made between the plowing and disking operations. This mixes the fertilizer with the topsoil, placing it where it will be of most benefit.

The plowing and fertilization recommended in establishing new lawns and renovating old lawns in the South can be done any time during spring or summer when there is sufficient moisture in the soil for plowing. The sooner it is done after the first of March the greater will be the growth of grass the first season.

A well-planned and well-kept lawn pays dividends in beauty. It forms a complimentary background for house or garden, and is worth the care and expense involved.

A desirable grade or slope and smooth surface should be secured during the tilling operations. The slope should be gently away from the house, not exceeding a one-foot drop in a 100 horizontal feet for the first 50 feet. Pockets or slight depressions should be avoided by dragging the surface, after harrowing, with a heavy, board drag.

How and When to Plant

Best results are usually had by sowing the lawn grass seed after a good rain or soon after plowing and disking, when there is considerable moisture in the soil. A windy day should be avoided for seed sowing, as an even scattering of the seed cannot be secured. A roller should be used immediately after sowing of the seed to insure good contact between the soil and the seed. This is very necessary if seed of Bermuda grass is being used. Avoid cheap seed or those not free of weed seed.

Where Bermuda sod is used, open furrows 4 inches deep and 12 to 18 inches apart. Drop pieces of sod about the size of one's fist 12 to 18 inches apart in the furrows and cover. The surface should be made perfectly smooth. Sodding may be done any time of the year.

Satisfactory lawns can be established by thorough preparation of the soil and planting as outlined above, but even lawns constructed in this manner must be properly maintained to give continual satisfaction. Regular clipping and feeding will keep the lawn in good condition.

When the lawn is growing rapidly it should be cut every 10 days and the clippings allowed to remain on the lawn. If the growth is weak or moderately vigorous with a yellowish or pale green color, it needs a feeding.

The element that is usually the first to become deficient is nitrogen. This can be supplied in the form of nitrate of soda or ammonium sulphate as a top-dressing. Either of these two fertilizers can be applied at the rate of 200 pounds per acre or 2½ pounds per 1,000 square feet.

Cottonseed meal is abundant in the South, and when used as a top-dressing on the lawn it adds desirable organic matter to the soil. A mixture of ¼ sulphate of ammonia or nitrate of soda and ¾ cottonseed meal by weight, applied at the rate of 10 pounds per 1,000 square feet, is very satisfactory.

The top-dressing of nitrate of soda or ammonium sulphate should be applied every 4 to 6 weeks during the growing season, the first being applied just prior to the beginning of grass growth in the spring. If cottonseed meal is used with nitrate of soda, it should be applied every 2 months. Caution should be observed in applying this material, as it will burn the grass if it is broadcast while the grass is wet. It should be distributed when there is no dew or other moisture on the lawn, and a heavy watering after it is spread is desirable. Strive for an even spread of the fertilizer, as an uneven application will make a spotty lawn. Broadcast the fertilizer as one would broadcast seed.

There is evidence to indicate that for Southern lawns the addition of potash to the nitrogen top-dressing is to be recommended. The first or second applications should be supplemented with 4 pounds of muriate of potash per 1,000 square feet.

A suggested cultural and fertilizer schedule for Southern lawns:

A. New lawns and renovating old lawns:
   1. Apply 1,000 pounds of well-rotted manure or compost to each 1,000 square feet.
   2. Plow as for a garden in February, March, April, or May.
   3. Add 25 pounds of 6-8-8 fertilizer to each 1,000 square feet.
   4. Disk, harrow, drag, and seed or sod immediately. Seeded or sodded ground should be rolled with a 500-pound roller.

B. Maintaining well-established lawns:
   1. Mow regularly once a week during periods of rapid growth. Set

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PICTORIAL

When the Northern winter moved South this year, it played havoc with such Florida scenes as this.

Above: The 1939 farm-account book is important in making plans for 1940.

Below: Farm election boards give their responsibilities due consideration.

Above: An old-fashioned sleigh ride was fun for young and old.

Below: A snow scene which does not thrill—especially the owner.

Tasks are not so distasteful when one has company in performing them.

The Editors Talk

Southern Agriculture Takes Its Inventory

Gathered in their 41st annual convention, more than 1,000 members of the Association of Southern Agricultural Workers met in Birmingham, Alabama, on February 7-8-9 to take stock of the assets and plan for the future of Southern agriculture. Around the central theme, "The Next Step in a Balanced Agriculture for the South," large groups discussed work recently done and future programs involving such important phases of rural betterment as soil conservation, agricultural engineering, phytopathology, horticulture, home economics, agricultural economics, rural sociology, agronomy, soil management, crops, animal husbandry, dairy science, entomology, forestry, plant physiology, marketing, vocational agriculture, and informational services.

As would be expected, the status of cotton was ably presented. A general consensus of opinion seemed to indicate that the South will show less devotion to the crop which made her famous and will seek solution of her farm problems in diversification of crops and a greater interest in livestock. Emphasis was given to the "live-at-home" program, and the considerable progress which has been made in educating farmers away from thorough dependence on one or two cash crops was outlined.

Importance of Soil Testing Discussed

In the field of soil management, short-testing of soils to determine their fertilizer needs received much attention. Various papers brought out the fact that while methods are available to show differences among soils, much work is needed to correlate these tests to Southern crop needs. The tests now being used differentiate between soils of medium fertility on a rather consistent basis. However, on soils of very high or very low fertility, the tests do not seem to give such accurate results. In the case of high fertility soils, this is not considered very important from a practical viewpoint. Farmers on such soils probably have enough income so that the use of a slight excess of plant food would not be a great drain on their financial resources. Farmers on low-fertility soils may have a lower income and must use their money to greater advantage. It is, therefore, important that they receive information which will enable them to fertilize most efficiently.

It is planned that soil tests will be conducted by State Experiment Stations and State Authorities, but before these tests are very extensively used, they must be correlated to Southern cropping conditions, so that recommendations based on the tests can be made with more confidence than is now possible. This work of correlation is to be undertaken, and certainly will be a big aid in diversification.

The convention of the Association of Agricultural College Workers is probably

one of the largest, if not the largest, and most important gatherings of agricultural advisers in this country. It is a veritable "clearing house" for the exchange of ideas of highly trained people who from their work and contacts have their "feet on the ground." From their opinions are finally formulated the broad programs for the South which are so important to the progress of the Nation. We congratulate the Association on the depth of its concepts, the sincerity of its workers, and the excellent cooperative spirit and enthusiasm so evident in its meetings.

Soil Information on a Mass Basis

An interesting instance of mass soil-testing is noted in a contribution of the American Consulate General, Frankfort-on-Main, to World Trade Notes on Chemicals and Allied Products, Vol. 14, No. 2, January 13, 1940. The report is headed, FERTILIZER CONSUMPTION EXPANSION ENVISAGED—GERMANY, and reads as follows:

"A national program has been developed in Germany for the systematic testing of soil by new photo-electric methods with a view to the more effective use of fertilizer for expanding soil productivity to maximum levels. The program provides for each of the 70 agricultural experimental stations situated throughout Germany conducting initially some 25,000 soil tests annually, the number to be increased to 100,000 annually per station as the program becomes well established. It is expected that it will be possible to rationalize the application of commercial fertilizer in accordance with the ascertained fertility of the soil and in this manner further increase the productivity of German farm land.

"German consumption of fertilizer has risen markedly in recent years under the stimulus of the national campaign for maximum crop yields, as shown by an increase (Old Reich, excluding Austria and other annexed territories) for nitrogenous fertilizers, from 383,000 metric tons N in 1933-34 to 633,000 tons N in 1937-38; for potash from 718,000 to 1,156,000 tons K_20, and for phosphoric acid from 471,000 to 690,000 metric tons P_20_5. However, it is felt that, for achieving maximum crop results, it will be necessary to still further expand the nation's fertilizer consumption to annual levels of 1,162,000 metric tons for nitrogen, 1,021,000 tons for phosphoric acid, and 1,842,000 tons for potash; equivalent to an increase above 1937-38 levels of almost 90 per cent for nitrogen; almost 50 per cent for phosphoric acid, and 60 per cent for potash.

"The conducting of soil analysis tests upon such a large scale is said to be possible through the recent development of simple, inexpensive but highly accurate testing methods by photo-electric means based upon the use of photo-electric cells and principles of spectral analysis. Tests can be carried out rapidly by trained workers, and there is no need for tedious methods of chemical analysis requiring the services of scientifically trained personnel."

Because of the widespread and increasing interest in soil testing in this country, the results of this nation-wide, systematic application of soil testing and the practicability of the methods used will be closely watched.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ The Departments of Agronomy, Vegetable Crops, Pomology, and Floriculture and Ornamental Horticulture of the New York Extension Service cooperated in drawing up the fertilizer analyses and materials for 1940, in Agronomy Leaflet 9, "Approved Fertilizers for New York." Among the analyses appearing on the recommended list for the first time are 0-20-20 and 0-12-12, which are advised for alfalfa at seeding or as a top-dressing on soil not recently manured. The 2-8-12 analysis is also a new-comer for certain vegetable crops grown on muck soil.

Such grades as 3-12-6, 4-12-4, 5-10-5, 5-20-10 and 6-18-6 are frequently advised for grain and soybeans in a rotation not manured and not following legume sod. Fertilizers having the 1-1-1, 1-2-1, and 1-2-2 ratios as 7-7-7, 5-10-5, and 5-10-10 are generally recommended for most vegetable crops grown on soils other than muck.

In addition to suggesting the preferred fertilizers for other crops like pastures, fruit, and ornamentals, this valuable leaflet presents a chart showing how to "get more for your fertilizer money." A dollar in 1939 bought about 9% more plant food in a high analysis fertilizer represented by 5-10-5 compared with that in the low analysis 4-8-4 grade. The same dollar purchased a little over 25% more plant food in the double strength 10-20-10 grade compared with the low analysis fertilizer.

"Tobacco Fertilizer Recommendations for 1940," Ontario Agricultural College, Guelph, Ont., Can., Cir. H-5, 1939.

"Recommendations for Soil Management and Use of Fertilizers under War Emergency Conditions," Ontario Department of Agriculture, Toronto, Ontario, Canada, Oct. 12, 1939.

"Orchard Fertilization," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 205, Jan. 1940, T. A. Merrill.

"Cotton Fertilization in the Brown Loam Region," Agr. Exp. Sta., State College, Miss., Inf. Sh. 188, Dec. 1939, John Pitner.

"Suggested Fertilizers for West Virginia Farms," Agr. Ext. Serv., Morgantown, W. Va., 1940.

Soils

¶ Colorado Experiment Station Technical Bulletin 26, entitled "Color Photography in Soil Studies," by L. A. Brown and M. N. Langley, presents an interesting discussion of added information obtained by taking pictures of soil profiles in natural colors, which is accomplished by the use of film made especially to reproduce color. The authors point out that many good pictures have been published in bulletins which accurately show such features as thickness of horizons, structure, spots of lime or iron accumulation, etc. However, with pictures in black and white it has been impossible to show slight or even marked differences in colors of different horizons or the color nature of mottlings within individual layers in soil profiles.

A convincing illustration of the above is given in two plates, one showing a series of soil profiles reproduced in black and white and the other showing the same soil profiles reproduced by color photography. On the black and white plate the Terry soil, for example, appears as dark as the Keith soil, although the color plate correctly reveals the Terry to be a grayish brown soil developed on yellowish sandstone. The Keith soil is dark grayish brown.

First-hand directions on how to take the color pictures in natural color is given. A description of equipment satisfactory for this work and approximate costs are included in the bulletin.

"Seasonal Water and Nitrate Leachings in Relation to Soil and Source of Fertilizer Nitrogen (A Second Report on Windsor Lysimeter Series "A")," Agr. Exp. Sta., New Haven, Conn., Bul. 429, Oct. 1939, M. F. Morgan and O. E. Street.

"Alkali Soils and Waters in Montana," Agr. Exp. Sta., Bozeman, Mont., Cir. 101, Jan. 1939, Edmund Burke.

"Liming Western Oregon Soils," Agr. Exp. Sta., Corvallis, Oreg., Sta. Cir. 132, May 1939, R. E. Stephenson and W. L. Powers.

"Composition, Rating, and Conservation of Willamette Valley Soils," Agr. Exp. Sta., Corvallis, Oreg., Sta. Bul. 365, July 1939, W. L. Powers, J. S. Jones, and C. V. Ruzek.

"The Acidic Properties of Peat and Muck," U. S. D. A., Washington, D. C., Tech. Bul. 690, Oct. 1939, Irvin C. Feustel.

"Prevention and Control of Gullies," U. S. D. A., Washington, D. C., Farmers' Bul. 1813, Sept. 1939, Hans G. Jepson.

"Saving Soil with Sod in the Ohio Valley Region," U. S. D. A., Washington, D. C., Farmers' Bul. 1836, Dec. 1939, Kenneth Welton.

"Report of the Chief of the Soil Conservation service, 1939," U. S. D. A., Washington, D. C., 1939.

Crops

¶ "Food and Life," the 1939 Yearbook of Agriculture, U. S. Department of Agriculture, is a comprehensive volume of facts dealing with one of the greatest of sciences and arts,—the feeding of animals and humans. Within its pages are innumerable technical and non-technical subjects which should appeal to individuals in all walks of life. The housewife especially will gain wide knowledge from the articles pertaining to food, mineral, and vitamin needs of man. These contributions are from nationally known workers in the realm of human dietetics and home economics. Likewise, the discussions on animal nutrition are by outstanding specialists whose opinions should be of much value to farmers.

Although two-thirds of the Yearbook centers around the nutrition of animals, this section contains much of fundamental value to human nutrition. The modern conception of human nutrition is based to a large degree on animal experimentation, the human being and the animal having fundamentally the same needs. Farmers may refer to this single volume and receive pertinent information on feeding his own family as well as his livestock. City folks on the other hand have to think primarily of feeding themselves, although the animal section should not prove entirely superfluous for even this class of reader.

The first part dealing with human nutrition includes a group of articles on human attitude toward food. Next there are four articles on human requirements for carbohydrates, fats, energy, protein, minerals, and vitamins. Following these are two articles on the content of these nutrients in food materials. In sequence are articles analyzing the present-day diets in this country, how these diets could be improved, food preservation and consumer safeguards, and the broad aspects of nutrition in the United States.

The longer list of subject matter relating to animal nutrition includes articles on the digestive processes in domestic animals, growth, fattening and meat production, pasture and range in livestock feeding, the nutritive value of harvested forages, what we need to know in livestock nutrition, and many other excellent topics.

¶ According to A. E. Wilkinson in Connecticut Extension Bulletin 274, entitled "Cauliflower," any check in the growth of plants caused by a lack of quickly available plant foods results in premature heading. The nitrogen requirement for growing early cauliflower is from 60 to 120 pounds per acre, phosphoric acid from 60 to 200 pounds, and potash from 60 to 180 pounds per acre. The plant-food requirements for growing late cauliflower are similar with respect to phosphoric acid and potash but somewhat lower rates of nitrogen are necessary under some conditions. Fertilizers suggested for the early crop are the 5-8-7, 6-6-8, 6-8-6, and 5-10-5

analyses to be applied at rates varying from 1,000 to 2,000 pounds per acre, depending upon the soil and previous treatment. For late cauliflower, the author suggests 4-10-6, 4-8-8, 6-6-8, and 5-8-7 at rates from 1,000 to 2,000 pounds per acre. At times it may be necessary to follow these applications with 150 to 200 pounds of nitrate of soda just as the plants are forming curds. Lime is very essential and should be used every time the crop is planted, the author states.

Among the other steps to consider in growing this important vegetable crop in Connecticut are rotation, soil management, selecting varieties, transplanting, cultivation, diseases and marketing. The present bulletin is a revision of number 173. Additional bulletins on other vegetable crops recently revised by the Connecticut Extension Service are referred to below.

"Sixty-fourth Annual Report of the Ontario Agricultural College and Experimental Farm, 1938," Ontario Agr. Exp. Farm, Guelph, Ont., Can., 1939.

"Colorado Farm Bulletin," Agr. Exp. Sta., Fort Collins, Colo., Vol. 11, No. 1, Jan.-Mar. 1940.

"Summer Squash," Agr. Ext. Serv., Storrs, Conn., Bul. 271 (Revised No. 189), Feb. 1939, Albert E. Wilkinson.

"Winter Squash," Agr. Ext. Serv., Storrs, Conn., Bul. 272 (Revised No. 188), Feb. 1939, Albert E. Wilkinson.

"The Farm Home Garden," Agr. Ext. Serv., Storrs, Conn., Bul. 273 (Revised No. 164), March 1939, Albert E. Wilkinson.

"Red Raspberry Culture in Connecticut," Agr. Ext. Serv., Storrs, Conn., Bul. 275 (Revised No. 172), March 1939, H. A. Rollins.

"Growing Early Cabbage," Agr. Ext. Serv. Storrs, Conn., Bul. 276 (Revised No. 148), March 1939, Albert E. Wilkinson.

"Annual Report State Board of Agriculture 1938-1939," Quarterly Bulletin, St. Bd. of Agr., Dover, Del., Vol. 9, No. 3, Sept. 1939.

"Twenty-fifth Biennial Report of the Department of Agriculture, from July 1, 1936 to June 30, 1938," St. Dept. of Agr., Tallahassee, Fla., 1939.

"Winter Wheat Varieties for Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 460, George H. Dungan, W. L. Burlison, Benjamin Koehler, and O. T. Bonnett, Dec. 1939.

"Tung Tree Culture," St. Dept. of Agr. and Immigration, Baton Rouge, La., 1939, H. C. Coleman.

"The Massachusetts Commercial Vegetable Grower," Agr. Ext. Serv., Amherst, Mass., Vol. 22, Jan. 1940.

"Fruit Notes," Agr. Ext. Serv., Amherst, Mass., Dec. 1939, W. H. Thies.

"Mississippi Farm Research," Agr. Exp. Sta., State College, Miss., Vol. 3, No. 1, Jan. 1940.

"The Effect of Root Temperature Upon the Absorption of Water by the Cucumber," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 309, Dec. 1939, R. A. Schroeder.

"Important Grasses and Other Common Plants on Montana Ranges, Description, Distribution and Relative Value," Agr. Exp. Sta., Bozeman, Mont., Bul. 375, Nov. 1939, Louis P. Reitz and H. E. Morris.

"Farm Research," Agr. Exp. Sta., Geneva, N. Y., Vol. VI, No. 1, Jan. 1, 1940.

"Seed-flax Production in Oregon," Agr. Exp. Sta., Corvallis, Oreg., Sta. Cir. 133, July 1939, D. D. Hill.

"The Value of Irrigated Pastures for Dairy Cattle," Agr. Exp. Sta., Corvallis, Oreg., Sta. Bul. 366, Sept. 1939, H. P. Ewalt and I. R. Jones.

"Farm Research in South Dakota, Fifty-second Annual Station Report, July 1, 1938-June 30, 1939," Agr. Exp. Sta., Brookings, S. Dak.

"Biennial Report, Division of Agriculture of the South Dakota State College of Agriculture and Mechanic Arts, 1936-1937 and 1937-1938," Agr. Exp. Sta., Brookings, S. Dak.

"Culture of New Fall Vegetables," Agr. Ext. Serv., Knoxville, Tenn., Pub. 225, May 1939, W. C. Pelton.

"Greater Values from the Cotton Crop," Agr. Ext. Serv., Knoxville, Tenn., Pub. 226, July 1939, H. E. Hendricks and G. E. Martin.

"Growing Raspberries in Vermont," Agr. Ext. Serv., Burlington, Vt., Brieflet 521, March 1939, Charles H. Blasberg.

"Report of the Chief of the Office of Experiment Stations, 1939," U. S. D. A., Washington, D. C., 183191, 1939.

"Report of the Chief of the Bureau of Plant Industry, 1939," U. S. D. A., Washington, D. C., 185616, 1940.

"Mulching to Establish Vegetation on Eroded Areas of the Southeast," U. S. D. A., Washington, D. C., Leaf. 190, Dec. 1939, Sydney Franklin.

"Strawberry Varieties in the United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1043, Sept. 1939, George M. Darrow and George F. Waldo.

"Culture and Diseases of Delphiniums," U. S. D. A., Washington, D. C., Farmers' Bul. 1827, Oct. 1939, Furman Lloyd Mulford and Freeman Weiss.

"Orach, Its Culture and Use as a Greens Crop in the Great Plains Region," U. S. D. A., Washington, D. C., Cir. 526, Sept. 1939, M. F. Babb and James E. Kraus.

Economics

¶ Since the inauguration of the Soil Conservation Service in 1933, something like 165 project areas have been estab-

lished in the United States. In these areas the Soil Conservation Service assisted farmers in working out conservation programs for the individual farms. It is now interesting to review the results of some of the projects which were established during the early stages of the program. Georgia Experiment Station Bulletin 203, "A Study of Farming in Sandy Creek Soil Conservation Demonstration Area," by W. E. Hendrix, gives such results.

The Sandy Creek project was established in 1934 and includes an area of approximately 104,000 acres, lying in parts of Clarke, Jackson, and Madison Counties in the Piedmont region. The farms included in the survey have been classified into three groups, on the basis of the slope: First, level to gently rolling farms; second, farms of moderate slopes; and third, farms having steep slopes. The farms were then further divided on the basis of the erosion into two groups, least-eroded and worst-eroded.

"None of the nine farms of level to gently rolling slopes were in the worst-eroded group; 11 of the 28 farms of moderate slopes were in the worst-eroded group; and 18 of the 27 farms of steep slopes were in the worst-eroded group." The methods used for the control of erosion were divided into three headings: land-use changes, rotation practices, and mechanical erosion control measures.

It was noted that the most important change in the acreage of clean-tilled crops under the Soil Conservation program has been a decrease in the cotton acreage, which resulted largely from the crop adjustment program. Since the decrease was proportional to the acreage previously grown, it was not greater on the steep farms than on the gently rolling farms. "In 1933 cooperating farms included in both the 1933 and 1937 surveys had less than .1% of the cropland in winter legumes, 9.8% in cowpeas alone, .8% in cowpeas and corn interplanted. In 1937 these crops had increased to 10.2%, 17.3%, and 15.1% respectively. The largest acreages of close-growing crops were on the least sloping farms, and the smallest acreages on the steeper and badly eroded farms."

It was pointed out that numerous factors underlie the failure of farmers to carry on sound conservation practices, but among the most important are the system of farming, low farm income, farm tenancy, and a high mortgage indebtedness.

The farming system in the area was centered about cotton as the main cash crop with other production limited largely to products used on the farm. There had not been an increase in crops being used to any large extent to supplement cotton as a source of cash income. Thus without any supplementary sources of income, further reduction in cotton acreage to comply with the land use changes needed for erosion control did not appear likely, despite an unfavorable outlook for cotton. The author found that there had been a slight decrease in livestock production in the area since 1933. In addition to more feed, increases in livestock production will require new cash expenditures for fences, buildings, equipment, and more widespread knowledge of better production and marketing methods. It is felt that any widespread increase in livestock numbers in this particular area will be very slow.

Farm income averaged only $51 per farm in 1937, which means that any methods or suggestions for erosion control must be of a type that will not involve any large cash outlay, although methods of increasing farm income should not be overlooked.

The tenant-operated farms ranked lower than owner-operated farms in percentage of cropland planted to close-growing crops, and the quantity and quality of mechanical erosion control practices being carried on. The owner-operated farms burdened by heavy debts had a higher percentage of cropland in soil-depleting crops than the owner-operated farms free of debt.

¶ According to the 1939 report of the State of Minnesota Department of Agriculture, Dairy and Food, Fertilizer Analyses and Registrations, sales of fertilizers in Minnesota in 1939 amounted to 13,455 tons. The leading analyses in order of importance were: 0-9-27, 3-14-6, high-grade superphosphate 43% to 45%, and 4-16-4. The total of 13,455 tons sold in 1939 compared to 13,778 tons in 1938 and 17,698 tons in 1931. Although some fertilizers are sold in practically every county in the State, the greatest concentration occurs in the southeastern sections with Freeburn County taking the greatest quantity. Based on the calculations from plant food actually sold, the average plant-food content of all fertilizers sold in the State was 27.46%.

"Production, Purchase, Sale, and Use of Specified Foods on Alabama Farms," Agr. Exp. Sta., Auburn, Ala., Cir. 81, Nov. 1939, Buis T. Inman.

"Annual Report of Commercial Fertilizers Agricultural Minerals, July 1, 1938 to June 30, 1939," St. Div. of Agr., Denver, Colo., Mimeo., Dec. 1939.

"Commercial Fertilizers, Report for 1939," Agr. Exp. Sta., New Haven, Conn., Bul. 430, Nov. 1939, E. M. Bailey.

"Quarterly Bulletin, State Board of Agriculture, State Laboratory, Fertilizer, Feed, and Seed Report, January-June 1939, Issued for Quarter Ending June 30, 1939," St. Bd. of Agr., Dover, Del., Vol. 29, No. 2, 1939.

"Factors in the Organization and Operation of Farms in an Upland Cotton Area of Louisiana," Agr. Exp. Sta., University, La., Bul. 309, Oct. 1939, R. J. Saville and S. B. Thornton.

"Official Inspections 173," Agr. Exp. Sta., Orono, Maine, October 1939.

"Minnesota Annual Crop and Livestock Statistics for 1937-1938," St. Dept. of Agr., St. Paul, Minn., Bul. 30, 1939.

"The Rural Population Resources of Missouri," Agr. Ext. Serv., Columbia, Mo., Res. Bul. 306, Nov. 1939, C. E. Lively and R. B. Almack.

"Some Rural Social Agencies in Missouri Their Nature and Extent," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 307, Nov. 1939, C. E. Lively and R. B. Almack.

"Relationship of Productivity of Farm Units and Their Ability to Pay Rent," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 308, Nov. 1939, Brown R. Rawlings, Jr. and O. R. Johnson.

"Commercial Fertilizer Report for 1939," Agr. Exp. Sta., Bozeman, Mont., Bul. 376, Dec. 1939, James T. Sparling and Edmund Burke.

"Cotton Marketing in the Coastal Plain Area of North Carolina," Agr. Exp. Sta., Raleigh, N. C., Bul. 325, June 1939, J. W. Wright and G. R. Smith.

"Farm Tenancy in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Bul. 239, Dec. 1939, John H. Southern.

"Cost and Efficiency in Producing Hops in Oregon," Agr. Exp. Sta., Corvallis, Oreg., St. Bul. 364, June 1939, G. W. Kuhlman and R. E. Fore.

"Farm Tenancy in Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 383, Sept. 1939, P. I. Wrigley.

"Prices and Pennsylvania Agriculture," Agr. Exp. Sta., State College, Pa., Bul. 384, Oct. 1939, Allen F. Anderson and F. P. Weaver.

"Commercial Fertilizers," Agr. Exp. Sta., Burlington, Vt., Bul. 453, Sept. 1939, L. S. Walker, E. F. Boyce, and L. E. Davis.

"Report of the Chief of the Bureau of Agricultural Economics, 1939," U. S. D. A., Washington, D. C., 188688-39-1.

"2 Families, One Farm," U. S. D. A., AAA, Washington, D. C., PC4, 16-11507.

"To Buy Abundantly," U. S. D. A., AAA, Washington, D. C., PC5, 16-11508.

"Plenty," U. S. D. A., AAA, Washington, D. C., PC6, 16-11509.

"Here's our Farm Program for 1940 for North Central Region," U. S. D. A., AAA, Washington, D. C. NCR, Leaf. 401, Nov. 1939.

"Trading for Others in Commodity Futures," U. S. D. A., Washington, D. C., Cir. 539, Oct. 1939.

"Economic Statistics Relating to the California Grape Industry," U. S. D. A., Washington, D. C., Mimeo., Aug. 1939, Donald R. Rush.

"Two Trends of Great Agricultural Significance," U. S. D. A., Washington, D. C., Ext. Cir. 306, June 1939, O. E. Baker.

"You've plenty of nerve, Rastus. The idea of stealing my chickens and then trying to sell them to me."

"Well, boss, I thought you'd pay a better price for these chickens since you raised 'em yo'self. You'd know what you wuz buyin'."

"Dad, what is an actor?"

"An actor? My son, an actor is a man who can walk to the side of the stage, peer into the wings filled with theatrical props, dirt, dust, other actors, stage hands, old clothes, and other claptrap, and joyfully say, 'What a lovely view there is from this window.' "

Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Die Ernährung der Pflanze, November 1939, Vol. 35, No. 11

THE INFLUENCE OF THE NEUTRAL SALTS OF THE ALKALI AND ALKALINE EARTH METALS ON PLANT GROWTH. *By H. Borriss, Bonn, Germany.*

This technical paper describes results of experiments to observe and study the effects of potassium, sodium, lithium, rubidium and calcium as chlorides, sulphates, and nitrates, on the growth of plants. The author first distinguishes growth in the technical sense from the common usage of the term. In the strict plant physiological meaning, growth refers to the irreversible increase in volume of the plant, and thus really includes only a part of the processes involved in the general total development of the plant. The determination of the dry weight of the plant as a measurement of growth is not necessarily correct. The various parts of the plant can conceivably grow not only by cell division, but also by a stretching of the cells. Usually both processes are involved in growth.

The difficulties of studying the effect of a single ion on growth are discussed. The omission of an ion to study what happens when it is deficient does not necessarily give one a true picture of what the ion really does in the plant, since the general rhythm of the plant's physiological processes is badly disrupted by the unbalanced nutrition. The author sought to minimize these effects by conducting his experiments under carefully controlled conditions, whereby those processes in the plant likely to be secondarily affected by the omission of an ion are reduced to a minimum. For this purpose, he used seedlings of several plants; grew them in the dark, at constant temperature, in a saturated atmosphere, and made his observations over only a comparatively short time. Dilute solutions of the salt to be studied were added and the length of the hypocotyl measured and compared with the length of a similar plant grown in pure water.

When each of the salts was tried on spurrey (Spergula), the potassium increased growth markedly, followed rather closely by sodium. Rubidium, lithium, and calcium in the order named depressed growth, compared to water. When tobacco (N-rustica) was employed, potassium again greatly increased root growth, with sodium a much poorer second, followed closely by lithium. Calcium had practically no effect, while rubidium was markedly depressive. The growth apparently was due to both cell division and cell lengthening, with the latter particularly important. The use of greatly diluted solutions of rubidium salts stimulated the root growth of spurrey up to about 60 hours, after which they depressed the growth slightly for about 50 hours, finally ending up about the same as water control at the end of 140 hours.

The favorable action of sodium on the spurrey roots led to another experiment, in which the plants were grown in water culture, with a regular nutrient solution, under normal growing

conditions. The potassium salt was replaced by sodium salt in one series, and in another, neither was used. Pure water was used as the control series. It was found that the sodium plants grew almost as well as the potassium plants. The solution without either of these ions produced plants that were smaller than those produced by water alone. The author believes the ability of sodium to replace potassium so well is specific for this and other plants, but is not general.

Corn cockle (Agrostemma) seedlings were grown with potassium chloride and potassium nitrate, with pure water as the check treatment. Another series was run with the corresponding calcium salts. The latter depressed the growth of the plants, while potassium nitrate increased the growth. Potassium chloride was beneficial, but not so effective as the nitrate. The potassium contents of the hypocotyl and cotyledons were determined in the plants with the two potassium salt treatments. There was much more potassium in the plants treated with the nitrate form than with the chloride. The percentage composition of the cotyledon receiving the nitrate was not much higher than the plants without potassium, owing to the much greater growth in the former case. This shows the misleading possibility of expressing plant analyses only in percentage of weight.

The paper is concluded with a discussion of the results in comparison with reports of similar investigations by other scientists.

NUTRIENT DEFICIENCY SYMPTOMS ON TOBACCO IN THE FIELD.

The excellent work by J. E. McMurtrey, Jr., entitled "Symptoms on Field-Grown Tobacco Characteristic of the Deficient Supply of Each of Several Essential Chemical Elements," and published as U. S. Department of Agriculture Technical Bulletin 612 (1938) is discussed and rather fully summarized by G. Rohde.

Annales Agronomiques, Vol. 9, Nos. 4 & 5, July-October 1939

BIOCHEMICAL DATA SUMMARIZED FROM VARIOUS EXPERIMENTS ON THE GROWING OF FORAGE AND TRUCK CROPS IN SOUTHERN FRANCE. *By R. Salgues, Brignoles, France.*

Growing sorghum on several soils with increments of potash and of basic slag resulted in best yields from the highest application of potash and slag, along with nitrogen. Protein and carbohydrates were increased, cellulose was decreased by the treatments. When several varieties of potatoes were grown with different treatments in different years, there were indications that potash applications increased the yield and starch content of the tubers. A direct comparison one year with sulphate of ammonia showed this material to increase yield, but with a tendency to decrease starch content. Experiments with melons showed that highest yields with the highest sugar content were obtained with the highest fertilizer application, which consisted of 10 tons manure, 1,000 pounds each of superphosphate and sulphate of potash, and 300 pounds of sulphate of ammonia per acre.

FERTILIZER TESTS ORGANIZED IN 1938 BY THE CIRCLE TO STUDY AND INVESTIGATE THE IMPROVEMENT OF HOPS IN BELGIUM. *By P. Elsocht and F. Hoed, Belgium.*

Experiments at four locations with different fertilizer treatments are reported. Both yield and quality of the hops were determined. At one location, best results were obtained with a fertilization of 200 pounds each of ammonium nitrate and nitrate of lime, 600 pounds of bicalcic phosphate, and 600 pounds of sulphate of potash, as against larger or smaller amounts of the nutrients. Manure and Peruvian guano had been applied over the entire area. At another location, increasing the potash up to 800 pounds per acre gave best

results. Applying 1,600 pounds of potash in 1937 and none the next year resulted in slightly lower yields compared to normal fertilization, but much better quality of hops both years. At the third location, best yield was secured with 100 pounds of nitrate of lime and 300 pounds of sulphate of potash in addition to phosphate and manure. An application of 20 pounds of borax per acre was made here on one of the completely fertilized plots, which increased the yield, but not the quality of the hops. At the fourth location the treatments of the plots did not increase the yield over the check plot. This probably was due to the very heavy manure application with 800 pounds of basic slag and 400 pounds of muriate of potash over the entire area before laying out the test.

Particularly interesting here are the results on a plot which received 20 pounds of borax per acre. The yields were favorable, and the quality better than on the regularly fertilized plots. On another plot, 900 pounds of magnesium sulphate were applied, with yields and quality being similar to that on the borax plot. In view of the results with borax and magnesium, the authors stated that additional experiments with these materials would be conducted in the future.

APPLICATION OF THE STATISTICAL METHODS OF R. A. FISHER TO CULTURAL EXPERIMENTS. *By P. Desaymard, France.*

The well-known statistical methods of R. A. Fisher as applied to agriculture, developed when he was at Rothamsted Experimental Station in England, are fully discussed. The author shows how they can be used to advantage in agronomic experiments.

Cotton Wilt and Root-knot Nematode

By D. C. Neal

Pathologist, U. S. Department of Agriculture, University, Louisiana

AS a result of recent surveys made by plant pathologists of the U. S. Department of Agriculture and Experiment Stations, many areas of the cotton-growing district of the Gulf Coastal Plain have been found to be heavily infested with the cotton wilt fungus, *Fusarium vasinfectum,* and also another parasitic organism, called root-knot nematode or eel worm, *Heterodera marioni.* In these regions the wilt disease has assumed considerable economic importance because of its greater virulence and destructiveness in the presence of nematodes in the soil. Where nematodes occur, swellings or knots form on the roots of the cotton plant as a result of the presence of the nematode parasite in the root tissues, and therefore growth and normal development of the whole plant, especially the root system, are restricted. This causes a lowering of resistance to attack by the wilt fungus, and under such conditions even the more wilt-resistant varieties of cotton may become infected and readily succumb to the wilt disease.

In recent experiments conducted in the greenhouse at the Louisiana Agricultural Experiment Station in which one wilt-susceptible and three wilt-resistant varieties of cotton were grown in

Ruston Sandy Loam soil heavily infested with both wilt and nematodes, all varieties under test developed approximately 70 per cent wilt within 40 days from date of planting. The root systems also were heavily infected with nematodes, and many plants were killed by the combined infection within 3 weeks.

Aside from the apparent breaking down of wilt resistance in special resistant varieties when nematodes attack the plant, another difficulty is involved. In addition to cotton, the root-knot nematode attacks many other kinds of plants, including some of the soil-building crops such as Austrian peas, vetch, and certain varieties of soybeans, and if they are planted for soil improvement in areas where both wilt and nematodes are prevalent, the nematode population of the soil may be increased and the wilt disease made correspondingly more destructive in subsequent cotton plantings.

Fortunately, certain crops such as oats, rye, corn, cowpea (Brabham or Iron), velvet bean, soybean (Laredo variety only), and some of the clovers, particularly burr and southern giant burr, and Melilotus indica are resistant to the root-knot nematode and may be used successfully in rotations or as cover crops in areas where both wilt and root-knot nematode are factors in reducing cotton yields.

The crotalarias, *Crotalaria juncea* and *Crotalaria spectabilis,* also are excellent crops for rotation control of the root-knot nematode in regions to which they are adapted.

In soil tracts where only wilt is prevalent, improved strains of wilt-resistant Dixie-Triumph cotton and Delfos 965-425, the latter recently developed by the Northeast Louisiana Experiment Station at St. Joseph, Louisiana, may be grown with satisfactory results. Root-knot nematode appears to be restricted to the lighter, sandier soils of the Gulf Coastal Plains and has never been found to be destructive to any great extent in the heavier clay or alluvial types.

For further information on this subject inquiries should be made to the United States Department of Agriculture or State Experiment Stations located in the cotton belt of the southern states.

Lawns for the South

(*From page* 22)

mower to cut grass 2 to 3 inches in height.

2. Water thoroughly, if possible, every 2 weeks during dry periods.
3. Apply a mixture of ¼ sulphate of ammonia or nitrate of soda and ¾ cottonseed meal as a top-dressing. This material should be applied at the rate of 10 pounds per 1,000 square feet. Better results will be secured if 4 pounds of muriate of potash are added to every 10 pounds of the cottonseed meal and nitrogen mixture. Apply this at the rate of 14 pounds per 1,000 square feet. Make first application in early spring and apply succeeding application every 2 months. For instance, if the first application is made March 1, other treatment should be made May 1, July 1, and September 1. Do not apply this top-dressing after October 1.
4. English rye grass can be planted in well-established sod for a green

winter lawn. Sow seed at the rate of one pound per 100 square feet in October, November, or December. Rake in with the back of a rake.

Watering during the summer is particularly beneficial to new lawns. Fertilizers can be used by the plant only when there is moisture present to put it into solution; however, soil well supplied with nitrogen, phosphorus, and potash will support grass during dry periods more satisfactorily than poor soils. When watering soak the lawn to a depth of 6 inches every 2 weeks. Do not sprinkle lightly every few days, because this brings the roots to the surface. Shallow roots die quickly in dry periods.

Healthy Hunger

(*From page* 17)

soda per acre. The check plot which has had no treatment was a rather sorry looking piece of sod when I saw it in mid-October. Mr. Price said the fertilizer treatment was bringing his pastures to where he was approaching the proverbial cow-to-the-acre plan of grazing. This means milk that can be sold at a profit for manufacturing purposes.

All through that mountain country where farmers are selling milk to the Kraft Company at West Jefferson, the Biltmore plant at Asheville, the Pet plant at Waynesville, the cooperative creamery at Brasstown, and the Nantahala Creamery at Franklin, it has been found that better pastures are needed. Applications of limestone and TVA phosphate are working wonders on the soils and are promoting better growths of grass and legumes, but a few demonstrations also indicate that, here too, land which has become healthy will also become hungry, and potash applications are profitable.

A rather unusual use for potash, one may say, who thinks only of its use with potatoes, tobacco, corn, or cotton. A rather unusual place also, thinks he who considers potash valuable only for muck soils or for the thin soils of sandy coastal plains. But these strong piedmont clays and mountain loams respond well, the evidence seems to show, once they have been made healthy. They get hungry, and until that hunger is appeased, the best results are not secured.

Lime is Your G-Man

(*From page* 19)

heat in the larger rock would be greater than that of the small rock in proportion to their relative sizes. Thus, soils can have the same pH value and still differ greatly in lime requirement.

The table on the opposite page shows the pH values within the soil range and some lime and crop relationships.

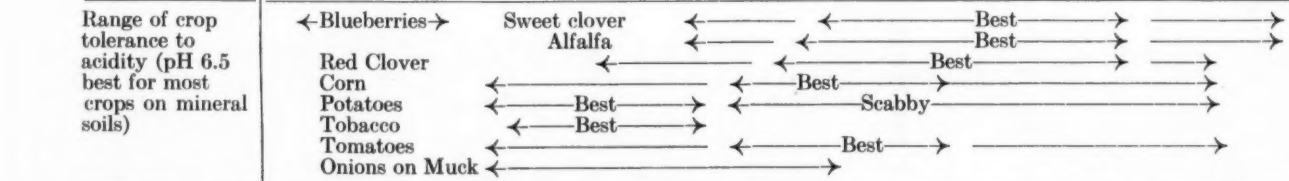
How Much Does It Pay To Correct Soil Acidity? Results from Indiana field experiments with 3- and 4-year rotations including legumes demonstrate the following facts:

When pH = 4.7, $1.00 spent for lime returned $12.34 (Wanatah Field)
When pH = 5.0, $1.00 spent for lime returned $5.70 (Jennings Co. Field)
When pH = 6.0, $1.00 spent for lime returned $3.00 (Bedford Field)

SOME pH VALUES AND SOIL AND CROP RELATIONSHIPS *

pH scale	4.0	4.5	5.0	5.5	6.0	6.5	6.7	7.0	7.2	7.8	8.0	9.0
	Extremely acid	Very strongly acid	Strongly acid	Medium acid	Slightly acid		Neutral		Alkaline		Strongly alkaline	
Occurrence	Rare	Frequent	Most soils in humid regions when not limed.		Soils when limed						Occurs only in arid lands.	
	Tons of lime per acre to bring pH to 6.5 (Approximate guide)											
Sandy and silt loam soils	6.0	5.0	4.0	2.0	0.5	0						
Clay soils	8.0	7.0	5.0	3.0	1.0	0						
Muck soils	12.0	10.0	8.0	6.0	3.0	0					Sulfur should be used here	

Range of crop tolerance to acidity (pH 6.5 best for most crops on mineral soils)



What is the situation in the soil at different pH values?

Low availability of—
- Phosphate (Fixed by iron)
- Lime (Leached out)
- Potash (Leached out)

Bacteria grow poorly here.
Fungi thrive.
Organic matter does not readily accumulate.

Best pH for: Phosphate, Lime and for Nitrogen fixation by legume and organisms.

Organic matter accumulates here.

In soils with pH above 7.5 the Phosphates are fixed by calcium (lime), Boron, Iron, Magnesium, Manganese and Potassium are likely to be very deficient.

Conclusion: For a most fertile mineral soil, lime to a pH as near to 6.5 as possible; for muck the optimum pH for most Indiana crops is approximately 5.6.

* From Indiana Circular 162, revised, 1939.

Peruvians Pick Cotton All Year

Cotton picking in Peru is not a seasonal job as it is in the cotton districts of the United States, and as a result there is no rush marketing season as there is elsewhere, says Charles H. Barber of the Office of Foreign Agricultural Relations in a survey report of South American cotton as it comes into competition with American cotton.

The cotton areas of Peru are semi-tropical and there are no killing frosts, and no rains to discolor the fiber. Guano, a natural fertilizer, is abundant nearby. The fruiting of the cotton depends on the time of planting, and the planting date depends on the period when irrigation water is most plentiful. Irrigation in turn traces back to the melting of the snows in the Andes, and the time of rapid melting moves southward gradually with the seasonal shift of the sun. The result is that cotton is being harvested in some part of Peru almost the year round, says Barber.

Pasture Problems Still Unsolved

(*From page* 14)

age protein in the forage produced from each plot treatment is given in the last column. The increase in protein due to treatment is, of course, reflected in the figures, in that the comparative yields of protein are higher than for dry matter in all cases. In the plots receiving nitrogen, the nitrogen was held constant in all treatments, at 50 pounds of elemental nitrogen per acre.

The 12-4-4 treatment reflects the need for more phosphoric acid and potash than this fertilizer carries, since the application of small amounts of these minerals does not appear to be sufficient to stimulate wild white clover in the stand, whereas in both the 0-20-20 series and in the complete fertilizer plots wild white clover has been very abundant. This is reflected in the protein percentages of 19.7% and 18.6% respectively, while in the 12-4-4, the protein of the forage averaged but 16.5%. Feeding value of the forage produced, judged by the total protein content, was raised about 50% by the nitrogens and by the 12-4-4, doubled with the 0-20-20 and increased 2½ times by the complete fertilizers.

To further show how effective phosphoric acid and potash are on this soil it is only necessary to observe the data for 1938, in the spring of which some of the plots that had previously received nitrogen were treated with an 0-20-20 fertilizer. This change was made because little or no clover was carried by the plots that had nitrogen and we wished to see not only how quickly clover would appear but how much it would increase the yield.

Clover came into the stand almost

Treatment	Dry Matter Yield	Protein Yield	% Protein in Forage
Av. 5 no-treatment plots	100	100	15.3
Av. 5 nitrogen carriers	122	148	18.5
12–4–4	141	152	16.5
0–20–20	151	195	19.7
Av. 4 completes 1–2–2 ratio	203	247	18.6

immediately and the yields jumped the first year as the following data well show.

Treatment	1938 Yields Dry Matter Yield	Protein Yield
No treatment.....	100	100
Av. 2 N plots.....	115	127
Av. 2 N plots with PK added 1938.....	186	219

Nitrogen was applied uniformly in both treatments receiving nitrogen at 50 pounds per acre, and the same two carriers were used in both cases. The increase recorded for the NPK plots is convincing that we get enough of the response on this soil for phosphoric acid and potash, and the rapidity with which these elements bring in clover is very startling.

We have much evidence on this soil to prove that potash encourages the development of clover more than phosphoric acid. One plot in the test was given an annual application of 200 pounds of 50% muriate of potash per acre. Yields of dry matter and protein, with untreated plots at 100, have averaged 120 and 140 respectively. The proportion of clover in the sward is higher than in any of the other plots.

In another case we are comparing a nitrogen-phosphorus carrier, 11-48-0, and nitrate of potash, 13-0-44, equal amounts of nitrogen being used. The difference in the swards of the two plots is very striking, with much more clover in the nitrate of potash plot. Although our yields do not show a significant difference between the two, the cows recognize the difference, because the plot where nitrate of potash is annually applied is always much more closely grazed than the other.

Whereas we are certain that wild white and other clovers on this soil are more dependent upon potash than other plant-food elements, still potash alone does not give maximum yields. In view of the results we have secured, we believe a balanced fertilizer program is necessary, that best results on pastures like this cannot be secured with superphosphate alone or with lime and superphosphate, but that best yields will come only when the fertilizer carries potash along with other things. Whether nitrogen is used depends upon the proposed intensity of grazing, as well as upon the need for more pasture on the farm during the forepart of the pasture season when the response from nitrogen is mainly secured. So far as this pasture is concerned, we have not crowded out clover with nitrogen in complete fertilizers, since the pasture is closely grazed, but the nitrogen-alone plots do not bring in clover as has been previously stated.

Moreover, a heavy rate of fertilization has been used here, complete fertilizers equal to 625 pounds of an 8-16-16 formula, and 50 pounds of nitrogen per acre in all cases where this element was used. We should, of course, expect large increases of forage on a reasonably good pasture under such heavy fertilization. Now the question arises as to whether these large applications of plant food have proved profitable.

Shows Profitable Results

Since the plots were managed by harvesting small equivalent areas at monthly intervals, there is but one way in which we can accurately evaluate the results, and that is to ascribe a certain value to the forage produced. Moreover, the dry-matter weights do not form an accurate basis for comparison, since the feeding value and apparent palatability depend more upon the chemical content of the forage itself. This can be fairly accurately measured by the protein of the forage, and fortunately we have the figures for this component of the herbage.

In the tabular summary that follows, we have calculated the returns on this basis, assuming that the feeding value, based upon dry matter and protein content of the young grasses and clover,

is equal to 80% of what it would cost in the grain bag. There is plenty of evidence pointing to its being worth more nearly its weight in concentrated feeds, but we desire to be reasonably conservative in our estimates.

	Returns for $1 invested
Av. 5 nitrogen carriers	$1.44
0–20–20	1.80
Av. 4 complete fertilizers	1.83

Applying this line of reasoning to the data in the first table, we arrive at the conclusion that all treatments more than pay for their cost, and that in the case of the complete mixture or in the one which carried phosphoric acid and potash, a farmer would nearly double his money even at these high rates of treatment.

	Returns for $1 invested
Av. 2 nitrogen carriers	$1.24
Av. 2 complete fertilizers	2.73

Now if we apply the same yardstick to the figures represented by the second table, which represents only one year, it must be understood by that a very good pasture year, the figures indicate even more conclusively that it pays to fertilize this pasture even at the extreme rates.

We realize, of course, that most farmers would not use as much plant food as we did in this particular trial. However, it is quite apparent that if a large application of fertilizer will pay its cost, and a profit as well, a smaller application will pay a larger profit, for in spite of all the evasion of economic laws going on in the world today, there is one that cannot be evaded, and that is the old law of diminishing returns. In other words, if a large application pays good returns, a smaller one will pay better returns on the initial investment.

How does this apply to the so-called permanent pasture that might be improved in New England? Obviously we would not care to impose our findings on all the New England States, but we have reasonable assurance from 25 or 30 smaller trials that the heavier soils will respond in much the same manner.

If a farmer is just embarking on a pasture improvement program, he will need to use caution in amounts of material as well as in the choice of a location to put that material. That the better areas of pasture should be improved first is now almost axiomatic. In a large number of cases the sod will not be good enough to warrant heavy annual applications, especially in locations where brushy growth is being brought under control. In these locations it may be better to start with lime and superphosphate, then after the sward becomes thicker, potash or complete fertilizers should be applied as conditions seem to warrant.

A Balanced Fertilizer Program

On the better areas of permanent pasture that are already established, and especially if they are well watered, a balanced fertilizer procedure should be practiced with superphosphate and potash, as well as lime where necessary. Trials in New Hampshire other than those reported here indicate that superphosphate and potash may be applied every third year in suitable amounts. Large triennial applications of superphosphate have given slightly better results than small annual applications in which the same amount of plant food is involved, while with potash the reverse is true. Nitrogen in almost any form can be depended upon to stimulate grass growth during the first half of the pasture season, and if more feed is needed during that period, this element should be used. Well-stocked areas are almost certain to need nitrogen

applications on some part of the pasture if high-producing herds are to be maintained.

Although most dairymen believe that a tillable pasture should always be plowed wherever improvement is desired, there is much doubt as to whether plowing is desirable in all such cases. Plowing turns down the organic layer which seems to be necessary at the surface of the soil for the permanent, shallow-rooted pasture plants. Unless an enormous supply of manure for treating such areas is available, it may often be better to avoid the expense of plowing and working the land and institute a cheaper system of top-dressing with suitable materials.

Northeastern dairymen are fairly bound to a heavy system of grain feeding. To embark on a program of pasture improvement means more expense, except insofar as Agricultural Conservation Program allotments are used for the purpose. These will be a great help in solving the pasture problem on a large number of farms when farmers use more of their allotments on their grazing lands.

What we know now is that if we take a dollar to the feed store, we bring back a dollar's worth of feed. What we wish were better understood is that if we take the same dollar and spend it for suitable fertilizers for the pasture, we will get back our dollar's worth of feed plus from 50% to 200% or more on the money invested.

When farmers realize how this can be done, the pasture problem of the northeast will be nearer a solution than it is today.

Balanced Fertilization for Apple Orchards

(*From page* 10)

deficiency will exhibit a number of leaves in which the browned or scorched areas are distributed in patches over the leaf, see figure 2, A & E. In addition, the area next to the scorched region does not present the olive colouration which generally occurs in potassium deficiency. This region is either normal green or chlorotic, see figure 2, A & C. In many cases the chlorosis appears before the scorch. This chlorosis occurs between the veins and is of a light yellow colour, see figure 2 B.

Until recently this trouble had not been observed in the field, but during the last 2 years it has occurred in Eastern Ontario and Quebec in certain areas, and was diagnosed partly by symptom and partly by analysis of the leaves.

Leaves exhibiting the symptoms showed only from 1.19 to 2.5% of magnesium in the ash, whereas leaves from trees free of the trouble showed a magnesium content in the ash of 5 to 6%.

Magnesium deficiency has been reported from abroad, one case in Europe having been diagnosed by leaves sent to Canada. In all cases there seems to be difficulty in quickly correcting the trouble. At present where this deficiency exists, the recommendation is to apply from 2 to 6 pounds of magnesium sulphate per tree, depending upon the age. Applications may be made in late autumn or early spring. Since it appears difficult to correct in one season, spraying experiments to determine the possibility of correction by this means are under way, but no definite recommendations based on results can be made at present.

Until recent years little attention was paid to the use of such chemicals as boron, manganese, and zinc. With the advent, however, of various fruit troubles in the form of cork in apples and rosette of stone fruits and citrus fruits, remedies were sought. It has been found that several troubles of the type mentioned above are associated with a lack of these minor elements. As we are dealing only with apples, our atten-

Fig. 10—An apple showing bitter pit.

tion will be confined to boron, manganese, and iron, as related to the physiological disturbances mentioned below.

In the foregoing paragraphs we have discussed the role of the major elements as affecting leaf and tree characters. There still remain two types of leaf troubles due to a lack of iron and manganese. This trouble is sometimes termed lime-induced chlorosis and is not uncommon on high lime soils. The leaves affected with this type of chlorosis turn a pale, mottled green; sometimes they bleach out to almost pale yellow or white. Certainly, in the early stages many leaves will be found in which the only green remaining is along the margins of the finer veins. The edges do not scorch, but many of the leaves ultimately dry up and fall off.

This type of trouble is common on alkali soils and is frequently due to an excess of lime interfering with the intake of either iron or manganese. Sometimes it is due to actual deficiency of these elements. It has been corrected in some cases by an application of iron to the soil in the form of iron sulphate at the rate of 1 pound per square yard of soil. In other cases where it is due to a deficiency of manganese, applications of 10 pounds of manganous sulphate per acre have aided in correcting the trouble.

Fruit Troubles—There are two general classes of troubles with apple fruits:

(a) Those that may be corrected by boron.

(b) Those which do not respond to boron treatment.

The troubles which respond to boron are classed as drought spot, cork or internal cork, and corky core. These troubles affect several varieties of apples common in this part of the country, such as Fameuse and McIntosh, Stark and Ben Davis.

Drought Spot—Figure 4 shows apples affected with drought spot in early July. The affected fruits are characterized by superficial or sunken, irregular, dead brown spots or patches in the skin of the fruit. Sometimes when apples are only slightly affected, they may appear at harvest time like figure 5 or, in bad cases, like those in figure 6. Since the trouble is generally worse in dry years on very dry soils, it has been called drought spot.

Corky Core—This is the most common trouble found with McIntosh. The outside of the apples appears perfectly satisfactory, but on cutting the fruit transversely the core area is seen to contain light brown, cork-like tissue, either in spots or in continuous bands. See figure 7.

Cork and Internal Cork—This form of the trouble is illustrated in figure 7. It may appear when the fruit is half grown, although probably at this stage it will not show externally. If the fruit is cut, however, it will show light brown spots of cork-like tissue scattered throughout the flesh of the apple, as in figure 9. Later in the season the fruit may present an appearance as in figure 8. The blushed or red portion of the fruit becomes darker in colour than normal, and the apple becomes deformed by a large number of knobs or elevations and depressions.

In all the aforementioned troubles, the drop of fruit is premature and abnormal. The corky core of the McIntosh is probably the worst of these

troubles, because it cannot be detected except by cutting the fruit, and frequently a lot of it gets on the market and causes dissatisfaction with the public.

All of the above troubles have responded to boron treatment, and recommendations for control are as follows: Drought spot and cork may be corrected by boron applications to a soil at the rate of 4 to 8 ounces of borax per tree, applied in spring or late summer and worked into the soil, if possible. To apply this, mix the borax with several times its volume of sand or dry soil to aid in spreading it. These soil applications may not be immediately effective,

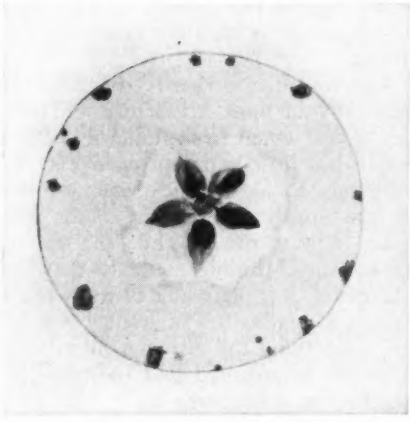


Fig. 11—Cross section showing bitter pit lesions.

if the soil is on the alkaline or high lime side. If the soil is alkaline or on the high lime side, immediate results may be obtained by incorporating borax with the regular lime-sulphur sprays. If this is done, two applications should be sufficient, one at the time of the calyx spray and the other the second spray after that, using borax at the rate of 2½ pounds to 100 gallons of the spray mixture.

Bitter Pit is a physiological trouble of apples which so far has not responded to treatment with boron. The trouble may be confused with cork, but there are distinguishing differences. In fact (see figure 10), the typical markings generally appear late in the life of the apple on the tree or perhaps are not recognizable until the fruit is placed in storage. The first symptom is the appearance of slightly discoloured spots deeper green on green fruit and darker red on red fruit, somewhat sunken or depressed, and generally regular in outline. They are likely to be more numerous towards the calyx end.

When an affected apple is cut, it shows groups of brown, broken-down pulp cells just under the skin in the flesh, see figure 11, and the affected tissue is generally confined to this area. No sovereign cure, such as boron, has been found for the trouble, but there is some knowledge available concerning its control. It occurs on Stark, Northern Spy, and Baldwin, but has not so far been definitely found on McIntosh or Fameuse.

While the trouble is associated with water relationship, it is extremely doubtful if that is the final answer. It is often found on shallow soils during years when there are periods of drought, but it has also been found in the deepest of soils under ideal moisture conditions. It has been induced by excessive feedings of manures high in nitrogen, and by the severe dehorning of trees not previously affected. It is also generally more prevalent on light crop trees than on those bearing a heavy crop.

Where it occurs, the only advice possible at present is to refrain from heavy nitrogen applications and not to attempt to force the trees. Adopt a complete fertilizer somewhat lower in nitrogen than ordinarily employed, say, about 2 pounds nitrate of soda to 2 pounds acid phosphate to 1 pound muriate of potash per tree. Avoid excessive pruning in any one season, and endeavour to maintain an adequate and continuous moisture supply. On sod orchards heavy mulching has aided in this connection.

In the foregoing pages an attempt has been made to show the importance of the major and some of the minor elements of plant food, and an endeavour

has been made to stress the importance of a balanced fertilizer programme. Since apple trees respond to nitrogen very readily and soon exhibit its deficiency, it is recommended that nitrogen be used as a balance wheel in the fertilizer programme. This means applying nitrogen separately from the other elements, as the trees indicate the need for it.

Fertilizer Recommendations

The annual applications of phosphoric acid and potash to be employed would vary a great deal with the type of soil, so that the following recommendations can only be used as a general guide. Assuming that a tree is producing 4 barrels of apples per year, 2 pounds of muriate of potash per tree or its equivalent in some other form would make up for the annual loss of potassium in the fruit. At 35 trees per acre this would equal 70 pounds of this fertilizer per acre, which is generally applied to the tree area only. But, in order to take care of cover crop requirements, whether in the form of a sowed crop or grass, 125 pounds per acre broadcast over a full bearing orchard has been generally recommended.

Since a 9-5-7 fertilizer has been found to be in the correct proportions for an apple tree, this amount of potash would require approximately 200 pounds of 20% superphosphate or 250 pounds of 16% superphosphate per acre. These should be applied on cultivated orchards when it is possible to immediately plow and cultivate. There is no objection to a late summer or early fall application of these minerals. The nitrogen may be applied in the early spring in the amounts required. This is best determined by the appearance of the foliage and growth during the previous year. In most cases one would not expect the amount of nitrogen required in combination with the aforementioned amounts of minerals to be more than 400 pounds of ammonium sulphate or its equivalent per acre. Certainly, if on a very poor sand it became necessary to use more nitrogen than this, then the mineral elements should be stepped up proportionately.

There are those who prefer a complete fertilizer and those who prefer to use ordinary barnyard manure. Where orchards are performing satisfactorily, that is, where they are located on fairly well-balanced soils, a complete fertilizer such as a 9-5-7 has been found satisfactory when employed. The rate of application would vary with the age of the trees and the soil, but for full-grown trees, applications up to 700 pounds per acre may be safely and profitably used on poorer soils. Where the soil is high in nitrogen and there is danger of an excess, a 4-8-10, although it is unnecessarily high in phosphorus, may be used to advantage at rates not exceeding the above.

On mulched orchards the 9-5-7 is generally the most satisfactory, and during a year when fresh mulch has been applied, a little extra nitrogen may be necessary to aid in the decomposition of the mulch; the foliage colour will soon indicate this. While the use of these rule-of-thumb methods may be successful, it is preferable to study one's trees and maintain a sufficiency of minerals, applying the nitrogen in varying amounts as required and indicated by the foliage symptoms.

Manure Can Be Used

Where manure is available, it may be employed successfully. On the average most barnyard manure is about correct in its proportions of N, P, and K for orchard use. Annual applications of about 6 to 7 tons of manure should be sufficient to provide the equivalent of 700 to 800 pounds of a 9-5-7 fertilizer per acre.

In closing, remember that poor growth accompanied by pale, small foliage, reasonably free from scorch troubles, indicates the need of nitrogen. Large, lush, dark green leaves indicate it is there in plenty. Watch your trees, keep up your mineral content, and use your nitrogen as your balance wheel.

Kidding Ourselves?

(*From page* 5)

the value of old truths. We think we know the truth about soil fertility but each year come fresh tests to confuse and deny earlier summaries.

If truth were easily found and quickly proven, if truth were something rigid and immovable, and not a live, dynamic, elusive element, it would be needless for us to spend the people's money on agricultural experiment stations.

So that's why I have little tolerance for somebody who knows it all and have heaps of respect for one who admits he is not sure he has all the answers. (It isn't entirely a case of my seeking congenial company either.)

Returning again for relief to Old Abe, I think he stands for the virtue of humor in meeting ponderous and unfathomable situations. Not only does humor relieve us from tense places but it leads onward to imagination—and imagination borders on *faith*.

Faith is the substance of things hoped for and the evidence of things not seen, according to Saint Paul the Apostle. (Paul once got jolted off his nag, you know, for too much belief in temporal power as a symbol of the ultimate truth.)

Philosophers, far older and wiser than we, have hinted that faith is mightier than materialism—and in these days materialism and science and profit and success are our favored bull's eyes on the target of truth. Yet it seems to me that anybody who sticks out his tongue at faith and salutes crass materialism is simply running down without any mainspring to get himself started again.

You don't have to be a mystic or a clairvoyant or a dippy dodo to pack around enough workable imagination so that your faith can survive a barrage of modern "truth." For we have truth that is good and truth that is depressing and unpleasant. Some truth is easy to assimilate and some truth is harder to understand than a falsehood.

But faith to a wholesome mind is something which leads on to realization of nobler achievements and finer human relations. Thus I regard faith of this kind as the seed of a superior kind of truth to come.

We begin by imagining better things to supersede the accepted truths of today, and gradually it feeds our faith until it germinates. Maybe we ourselves fail to harvest the crop, but somebody else borrows our seed of faith and plants it in more fertile ground under more happy cultural conditions.

SO THE fellow who depends entirely on ready-made truths and lacks the gumption to do a bit of truth-growing himself in his own back-yard garden is in no position to call somebody else a darn liar for using his imagination.

Under some circumstances the old adage is acceptable—"Truth crushed to earth will rise again;" but in our life and times it were better if we said "Truth today may be the Bunk tomorrow."

We chortle over the gullibility of long-gone generations. We snort at using moon phases for seeding, rabbits' feet for charms, bleeding folks to cure fever, divining rods to find wells, and ordeals to pick witches. We wonder how men could ever have thought the world was flat or that women didn't know enough to vote, when they run almost everything else.

Yet why do we chuckle? We still expect elections to bring salvation, traffic laws to stop accidents on roads lined with gin joints, and churches to make converts while "bingo" supports the pastor. We fertilize our soils and shudder at the surplus; we educate our children expensively and reduce their chances for using it honestly; we laugh at creeds and go in for cults; we condemn bigotry and rally in "blocs"; we praise democracy and organize pressure

groups; we banish idols but worship machines.

All of which is not said by way of sermonizing, but to emphasize the evidence that truth is inconsistent. True occurrences may be as inconsistent with facts *known* in the present just as true occurrences were inconsistent with facts *unknown* to our ancestors. Perhaps we have less excuse to forget facts and be foolishly inconsistent than they were to be inconsistent without facts.

Still we have improved many things since their day too. Thanks to imagination and faith, the folks who came before us made it easier for us to grope along and accomplish the *good* truths all about us. For this age has made the world better and brighter and banished many *bad* truths to make way for other ones we all delight in.

I suspect that along at this juncture you will want me to stay in America with my rejoicing over progress, because as things look abroad these days the big chiefs and their blind supporters haven't done as well with the truth as we have—maybe.

But gathering bits here and there from travelers and scanning with dubious analysis all press reports, I am inclined to think there are numerous tall liars involved in the mess, one bunch trying to fool us just a little further and faster than the other. I really think some of them are lying about the truth too, if you get me. I don't mind if somebody lies to me about a first-class liar, but I object to having really good things distorted and misrepresented.

Distance of course adds to the dilemma we find ourselves weltering in over the jumbled truth and fiction from overseas. We think that if we were just a mite closer to Berlin or Rome or Sverdlovsk or Ludefisk all things would sharpen up and stand out. However, we can often disbelieve things we see ourselves right next door, if we make up our minds not to accept it.

Take the national stump-blasting election fandango we are entering with such fond hopes in 1940. In most political campaigns there are no simple answers to big questions, except always to the candidates, to whom all problems are reduced to chart-class equations. As long as we are in the audience maybe that's the proper way they should be reduced, but nevertheless we get plenty of short-cuts to salvation, mostly to avoid detours in construction.

Just trot out anything you can mention. Maybe it's the battered old budget, as shot full of holes as Dillinger's hat; maybe the whimsical old AAA of mixed tribulations and victories; the complex and technical reciprocal trade treaties; the oft-confused "twin sitties" of public works, the PWA and WPA; or the smouldering question of whether we should "shoulder arms" or ship them; the economics of dividing up, paying up or closing up; and the crying need of old-age pensions as soon as you feel old enough to take them. All really very elementary.

WE HAVE had too much simplification of terribly overgrown truths to make them easier on fagged brains of voters who want more time for golf and motor boating. I know the candidates are not to blame for those truths being so oversized and overweight, but they might at least tell us that they're too big to handle without help. But they keep on telling us they can do it alone.

I am about at the point where I feel that the old style nominee, who merely shook hands, kissed the right kind of babies, and promised to give the country a cheaper and better cigar, has plenty to teach the new order of Solons. I for one shall miss his ilk from our bailiwick. He let us find out the truth for our own selves, and we remembered it longer!

But it's our supply of faith in American institutions which keeps us jogging along, paying taxes, and imbibing everybody's brand of gospel. In that vein I like to think of the old heroes like Washington and Lincoln, with admiration for their faith rather than adulation for their truthfulness.

And I guess most of us will need more faith than facts in 1940 anyhow!

TOO MUCH SLEEP

"I never felt so punk in all my life."

"Do any drinking last night?"

"Yes, and when I went to bed I felt fine. But when I woke up I felt terrible. It was the sleep that did it."

Candidate: "Then may I count on your vote?"

Voter: "Naw; I'll vote for the other fellow."

Candidate: "But you've never seen him."

Voter: "Naw! but I've seen you."

"She's a nicely reared girl, isn't she?"

"I should say so. Not bad from the front, either."

The sad-looking contractor scanned the menu card with a hopeless air. "You may bring me a dozen fried oysters," he said at last.

"I'se awfully sorry, boss," the colored waiter apologized. "But de fact is, we's outer all shellfish, 'ceptin aigs."

GIVE HIM TIME

Old Uncle Ezry had been very much occupied all by himself over in a corner near the fireplace. He was working industriously with a stub of a pencil and a piece of paper. Suddenly he looked up happily.

"Doggone!" he exclaimed, "if I ain't learned to write."

Maw got up and looked over the scrawled lines across the paper.

"What do it say?" she asked.

"I don't know," replied Uncle Ezry, puzzled. "I ain't learned to read yet."

The question in an ancient history quiz was: "Name two prominent ancient sports."

"Anthony and Cleopatra," wrote one freshman.

A small boy, sitting next to a very haughty lady in a tram car, kept on sniffing.

"Boy, haven't you a handkerchief?" she said severely.

The boy regarded her silently for a moment and replied: "Yes, I have, but I don't lend it to strangers."

ODD FIGURES

Shocked Old Lady: "And on the way up here we passed twenty-five people in parked cars!"

Young Hostess: "Oh, I'm sure you're mistaken. It must have been an even number."

"There isn't much to be seen in a little town, but what you hear makes up for it."

"Bring me some cold porridge," said the soldier to the waitress. "Burn some toast to a cinder," he added. "Fry two bad eggs and serve them on a dirty plate. Make the coffee so that it tastes like mud and bring it in a cracked cup so that it drips down my chin when I drink it."

The concoction came—and the puzzled waitress asked: "Is there anything more?"

"Yes," said the soldier. "Now sit down and nag me. I'm homesick."

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